APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

JULY, 1951

- HYDRAULIC CIRCUITS
- HYDRAULIC CONTROLS
- AIR CIRCUITS
- AIR CONTROLS
- ELECTRICAL AND ELECTRONIC CONTROLS

IN THIS ISSUE

REVAMP YOUR DRILLING MACHINES TO MAKE PRODUCTION RECORDS

2400 TUBES AN HOUR ON A CHAMFER AND EXPANDING MACHINE

YOU CAN CUT MORE GEARS AT LOWER UNIT COST

HYDRAULICS DOES THE WORK OF STEERING HEAVY-DUTY FORK TRUCKS

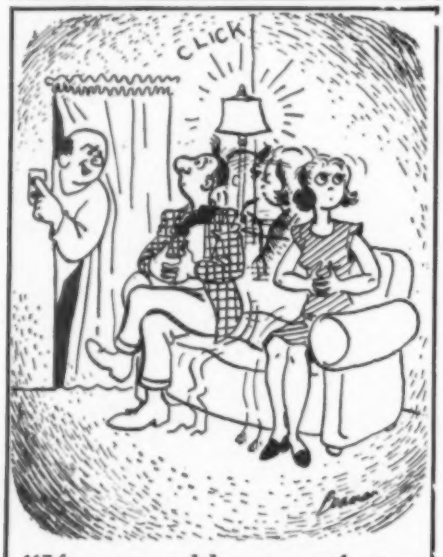
SPECIAL AIR FIXTURES SOLVE PRESS LINE PROBLEMS

BASIC ELECTRICAL CIRCUITS FOR HYDRAULIC PRESS CONTROL

"High pressures are normal for Aeroquip Hose Lines . . . but there is nothing normal about the pressure of orders nowadays."

Aeroquip

FLEXIBLE HOSE LINES
DETACHABLE, REUSABLE FITTINGS
SELF-SEALING COUPLINGS
"BREAKAWAY" • HYDRAULISCOPE
AEROQUIP CORPORATION, JACKSON, MICH.



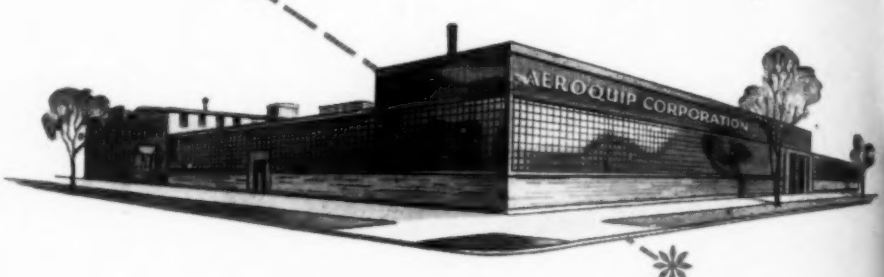
"If we could get as fast a 'break' on materials there'd be enough Aeroquip 'Breakaways' to go around."

Aeroquip

FLEXIBLE HOSE LINES
DETACHABLE, REUSABLE FITTINGS
SELF-SEALING COUPLINGS
"BREAKAWAY" • HYDRAULISCOPE
AEROQUIP CORPORATION, JACKSON, MICH.

Aeroquip

REG. TRADE MARK



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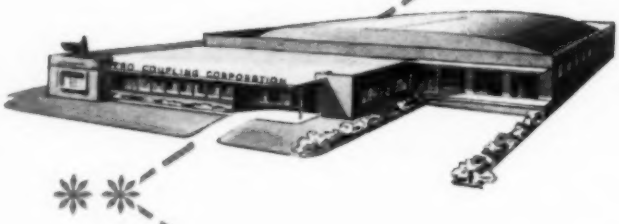


WAIT!

Today, when military and civilian demands for its products have doubled all previous records, Aeroquip announces the *completion* of a sizable expansion program. Two new structures and the acquisition of a new subsidiary have added more than 100,000 sq. ft. of highly productive space to Aeroquip's plant facilities.

It is not through mere chance that these important new additions are in operation *today*. More than a year ago the first warning signs that led to rearmament were recognized. Then, Aeroquip didn't wait for government prodding or financing, but with private capital and typical American initiative began a project which assures greatly increased production of vital Aeroquip products TODAY . . . *when they are of utmost importance.*

* *In Jackson, Michigan, there is a new 65,000 sq. ft. addition to the Aeroquip main plant.*

** *In Burbank, California, this modern 30,000 sq. ft. plant has just been completed.*

*** *Metalco, Inc., a new Aeroquip subsidiary, operates this plant in Cheboygan, Michigan.*

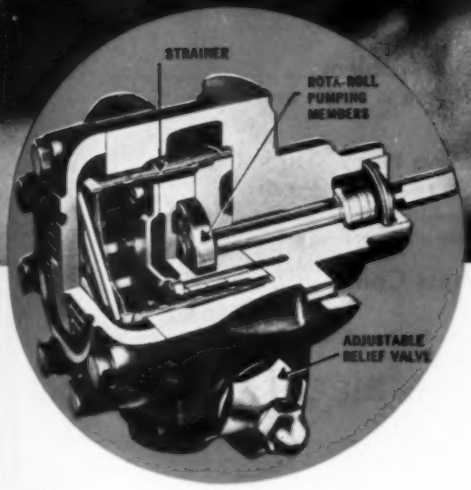
AEROQUIP CORPORATION

JACKSON, MICHIGAN

FLEXIBLE HOSE LINES • DETACHABLE, REUSABLE FITTINGS • SELF-SEALING COUPLINGS • BREAKAWAY COUPLINGS • HYDRAULISCOPE

Circle 1 on Reader Service Card

DESIGNERS! here's a low pressure pump with built-in relief valve and strainer!



Has every "wanted" feature

"ROTA-ROLL" PRINCIPLE of pumping members for quiet operation, long life.

SMOOTH UNIFORM FLOW at all pressures because rotating roller and rotor are self-emptying. No back-surging, turbulence or other interference.

HIGH VOLUMETRIC EFFICIENCY of approximately 90% is obtained.

ADJUSTABLE RELIEF VALVE which can be furnished in any of four pressure ranges: 20-40 psi; 40-80 psi; 80-150 psi; 150-300 psi.

LARGE, EASILY CLEANED STRAINER readily accessible, easily removed for cleaning.

SMALL AND COMPACT to readily lend itself to your design, improve product appearance.

LOW COST OF "ROTA-ROLL" PUMPING UNIT achieved through mass-production manufacturing.

*Based on a motor speed of 1725 RPM and 100 psi

Sundstrand "Rota-Roll" available now in 3 sizes . . . 11 to 40 gph*

Here's far more than just a pump! The Sundstrand "Rota-Roll" is a *complete pumping unit* including pump, adjustable relief valve, and strainer. It's a "ready made" answer to quickly solve problems of engine lubrication, compressor bearing lubrication, small capacity oil transfer and small cylinder actuation, for example. If you wish data on this versatile, low cost pumping unit, or have other hydraulic problems requiring *reliable* research, *expert* engineering, and *precision* production, come to Sundstrand.

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SUNDSTRAND MACHINE TOOL CO.

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applied HYDRAULICS

July, 1951 Vol. 4, No. 7

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Published monthly by THE HYDRAULICS PUBLISHING CO., an affiliate of INDUSTRIAL PUBLISHING CO., publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, DIE CASTINGS, FLOW, INDUSTRY & WELDING, and OCCUPATIONAL HAZARDS. Member, Controlled Circulation Audit, Inc.

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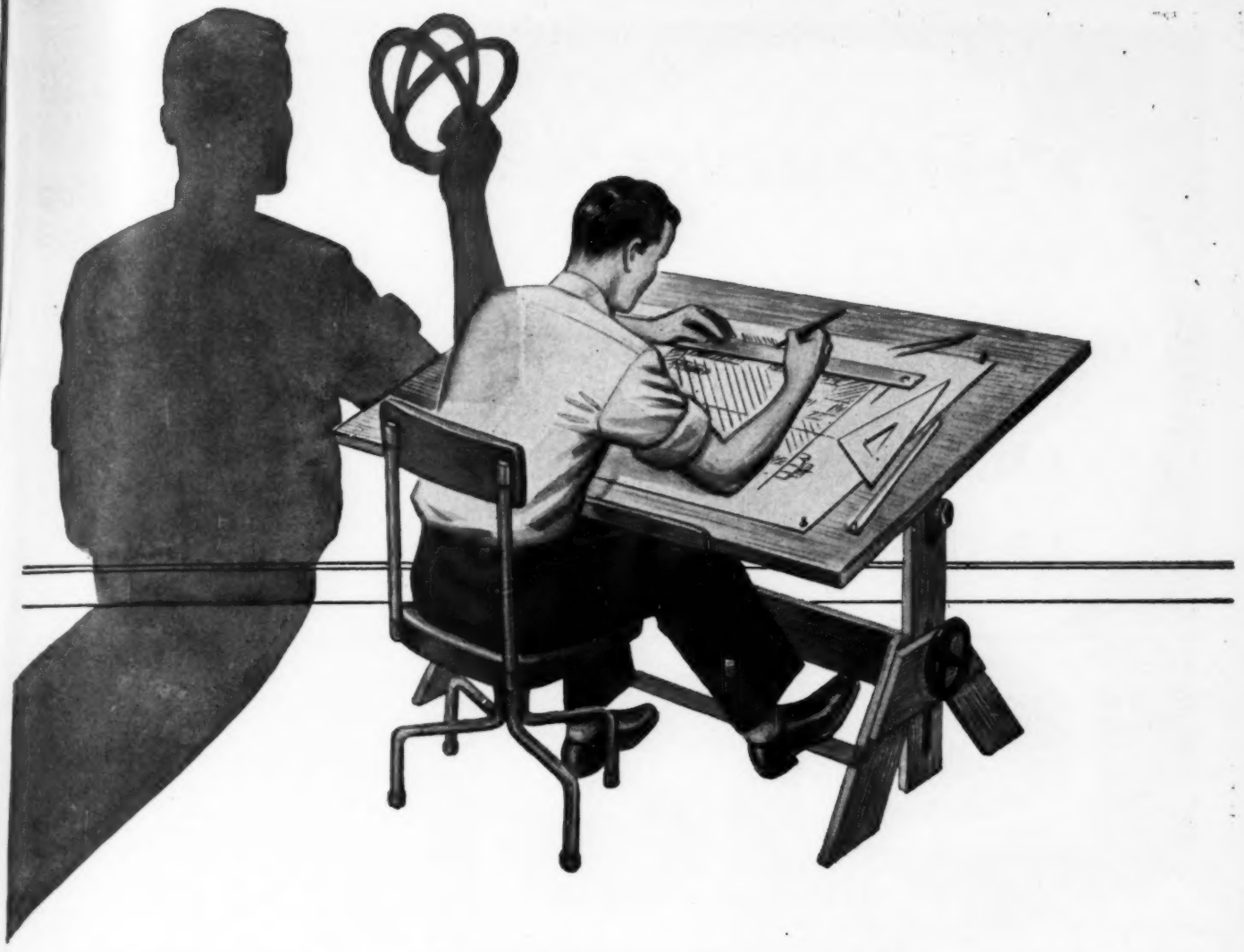

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In dozens of special packing requirements, engineers specify Sirvis packings because they have been found to stand up longer under extreme pressure, friction and the action of hydraulic fluid. No other type of packings requires less replacement than Sirvis.

● *Sirvis leather packings are engineered from top grade steerhide, specially tanned and treated. They are scientifically designed for all types of mechanical applications.*

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PERFECT Oil Seals

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LETTERS to the Editor

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C. D.

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Could you furnish the name of the supplier of the body hydraulic lift mechanism as featured in the "Better Cargo and Food Service" on page 54 of the May issue of APPLIED HYDRAULICS?

J. S. B.

We have referred your request to Northwest Airlines, Inc., Holman Field, St. Paul, Minn.

Can you give us the names of the manufacturers of hydraulic duplicators? Please include those that are combination air-hydraulic in operation.

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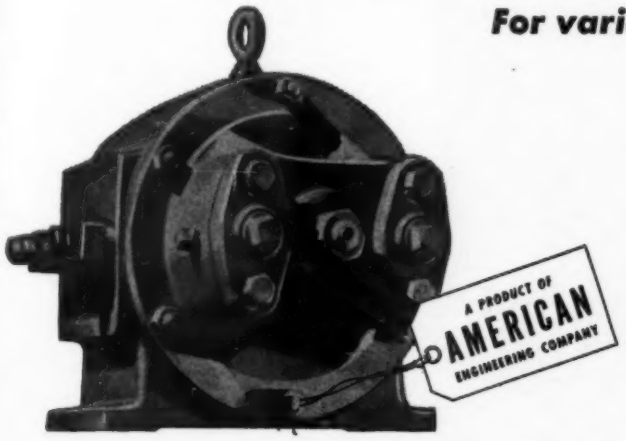
There are several types of automatic duplicators or tracers. In addition to the fully automatic and the air-hydraulic types, there are electrical-hydraulic and electronic-amplidyne types. Some units are two dimensional, others three dimensional models. Some units are built integral into machine tools; others are designed as

(Continued on page 17)

When it's high pressure... it's AMERICAN!



For variable pressures up to 3000 p.s.i. . . .

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THE FAMOUS HELE-SHAW is a radial-piston variable displacement fluid power generator. It is remarkably easy to apply to the machine it serves . . . may be installed on or near the machine, remote from it, or incorporated as an integral part of the design.

In the Hele-Shaw pump, pressure and reversal of flow are controlled directly at the pump. Discharge is infinitely variable from zero to maximum . . . and can be reversed instantaneously or gradually. Capacities range from 3¾ to 50 g.p.m. and upward.

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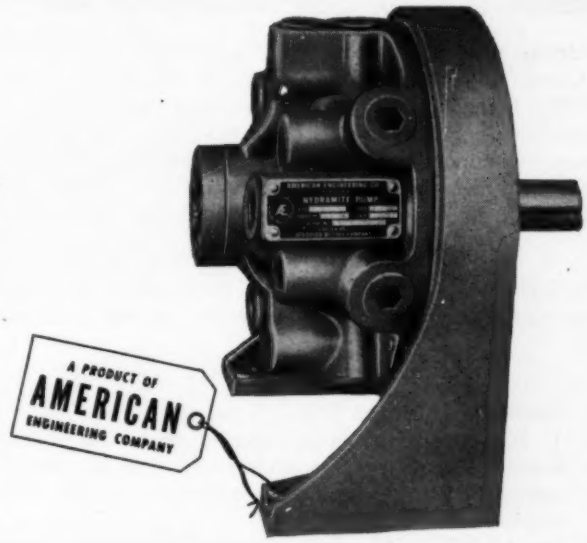

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AE Products include: Hydramite and Hele-Shaw Fluid Power, Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Lo-Hed Hoists, Lo-Hed Car Pullers

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2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: ☐ Kindly send me complete information about the new HYDRAMITE. ☐ Hele-Shaw.

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Address_____

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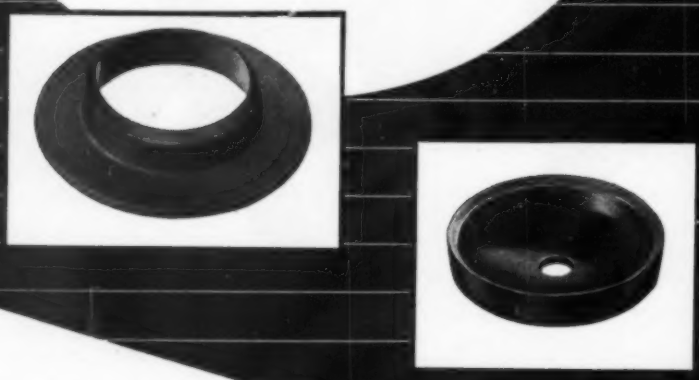

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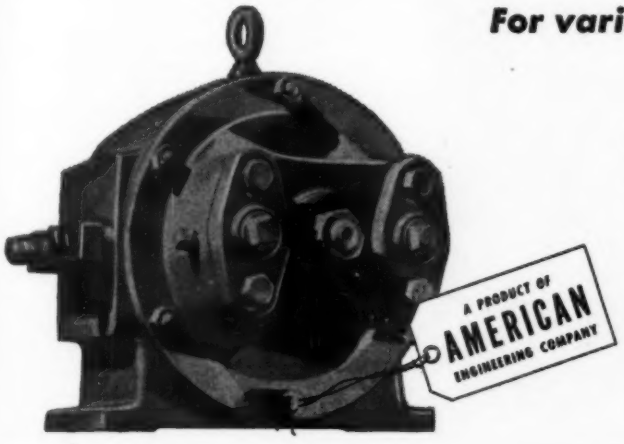

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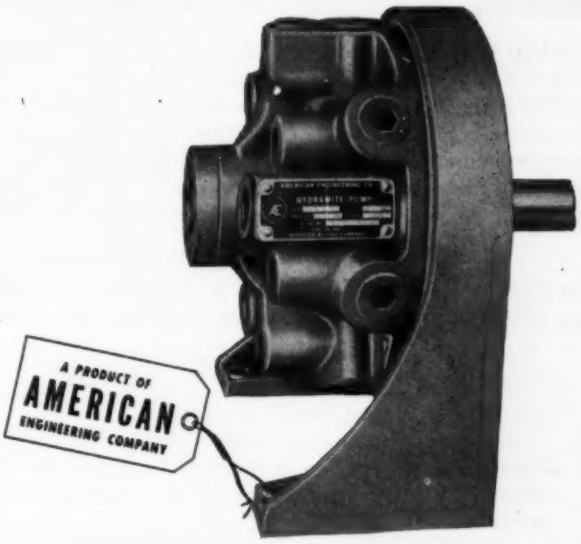

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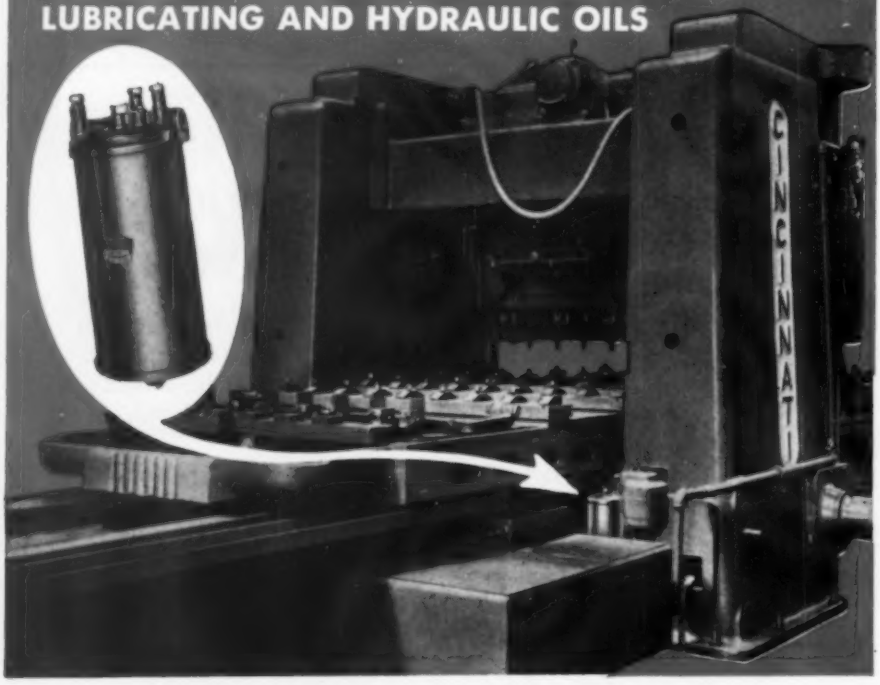

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FIRM NAME_____

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Pydraul F-9 did not flash or ignite when sprayed, at 1,000 p.s.i., into the 6,000° F. zone of an oxyacetylene welding torch flame.

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PYDRAUL F-9

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Color.....Light amber (APHA 350)
Specific Gravity.....1.266
Weight per Gallon.....10.56
Acidity (mg. KOH/gm.).....Less than 0.1
Odor.....Mild, pleasant
Pour Point.....+5° F.
Hydrolysis Stability.....
Neut. No. less than 0.1 before and after hydrolysis.
Antogenous Ignition Point ..Above 1100° F.
Viscosity at 100° F. 49.5—58.0 Centistrokes
229—269 S. U. S.
at 210° F. 5.6—6.0 Centistrokes
44.5—45.8 S. U. S.

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High Temperature Swivel Joints. For temperatures to 500°F. M.W.P. 700 psi.

Rotating Joints. For 150-lb. steam, brine, etc. Adapted for siphon return line.

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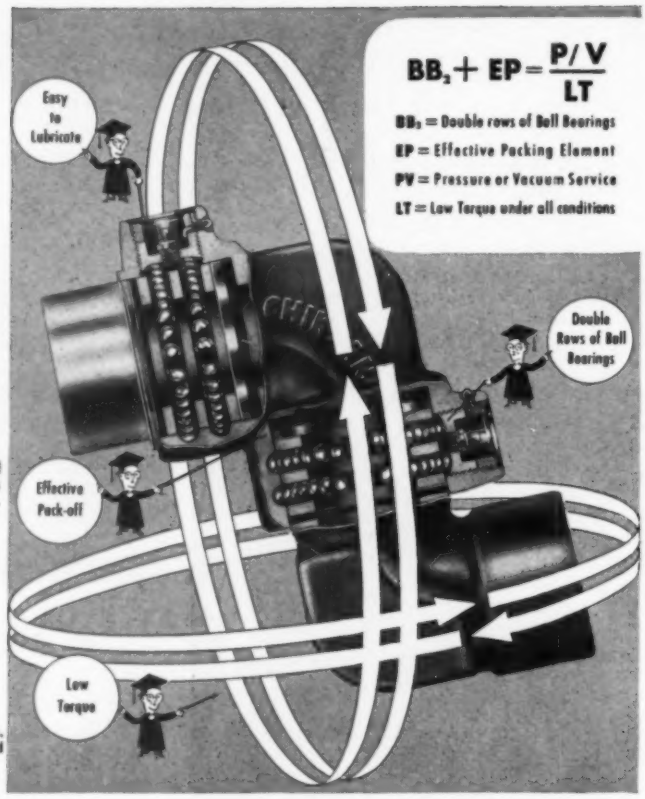
Hydraulic Swivel Joints. For pressures to 3,000 psi.


$BB_2 + EP = \frac{P/V}{LT}$
BB_2 = Double rows of Ball Bearings
EP = Effective Packing Element
PV = Pressure or Vacuum Service
LT = Low Torque under all conditions
Easy to Lubricate
Double Rows of Ball Bearings
Effective Pack-off
Low Torque

For over a quarter-century, here at CHIKSAN, we have specialized *exclusively* on developing and designing Swivel Joints* for all purposes . . . on manufacturing them to our rigid standards of precision . . . and on following through in the field to check performance under all sorts of conditions. That's why there is no substitute for CHIKSAN *Ball-Bearing* Swivel Joints* when it comes to efficient service with maximum safety . . . longest life . . . and minimum maintenance.

It costs you nothing to take full advantage of CHIKSAN's *specialized* experience. CHIKSAN Engineers will gladly cooperate with you in designing flexible lines to meet your specific requirements.

WRITE FOR CATALOG NO. 50-C. REPRESENTATIVES IN PRINCIPAL CITIES—SOLD BY LEADING SUPPLY STORES EVERYWHERE

*For full 360° rotation in 1, 2 and 3 planes. Unlimited flexibility in pipe lines is secured merely by arranging swivels in proper sequence. Over 500 different Types, Styles and Sizes for pressures to 15,000 psi; temperatures to 500°F.; pipe sizes from ⅛" to 12" and larger.

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Eagle Signal Corporation

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Hanna Engineering Works
C. B. Hunt & Son, Inc.
Hydraulic Equipment Co.
W. H. Nicholson & Co.

Valves, Hydraulic, Flow Control
Adel Division of General Metals Corporation

Valves, Hydraulic, Relief
Fulflo Specialties Co., Inc.

Valves, Hydraulic, 4-way, manual
Gre-Sen Manufacturing Co.

Valves, Hydraulic, 4-way, solenoid
Denison Engineering Co.

Letters to the Editor

(Continued from page 10)

accessories and are adaptable to a wide range of standard machine tools. The following companies make hydraulic duplicators: Cincinnati Milling and Grinding Machines, Inc., Lodge and Shipley Co., both of Cincinnati; Monarch Machine Tool Co., Sydney, Ohio; and Turchan Follower Machine Co., Detroit, Mich. Pratt & Whitney Division, Nles-Bement-Pond Co. East Hartford, Conn. also make a hydraulic duplicator designed especially for forging and similar dies.

I was especially glad to see the article by Rupert P. Esser on a timing relay circuit in the June issue. This kind of material is particularly useful to hydraulic sales engineers whose knowledge of electrical circuits needs brushing up. Here's hoping Mr. Esser has more material of the same sort.

P. G.

Mr. Esser's series was prepared by him as a result of numerous requests of our readers for parallel hydraulic (or air) circuits and electrical wiring diagrams. There will be at least six installments in the series.

Having just completed reading "Pressure Losses in the Flying Wing" contained in the May issue of your APPLIED HYDRAULICS magazine, I would like very much to get three copies of this article for the use of both myself and several other members of our engineering staff.

N. M. M.

We are sending three sets of tear sheets of this article. We would like to suggest that a routing system for copies of the magazine would permit each member of your staff who is interested to see specific articles each month. Some of our readers tell us that they clip and file articles of special interest. We recommend this practice to you also.

We are building a machine in this country (England) for an American customer which requires the following equipment: one 4-way Style E, one inch W. W. Nicholson Co. valve, class A-1 material, 60 degree, no "off" position; one one-half inch 4-way Hannifin packless air control valve, Model K-50; one Logan air reducing valve and lubricator No. 2. As we have no postal addresses for these companies and we understand they are advertisers

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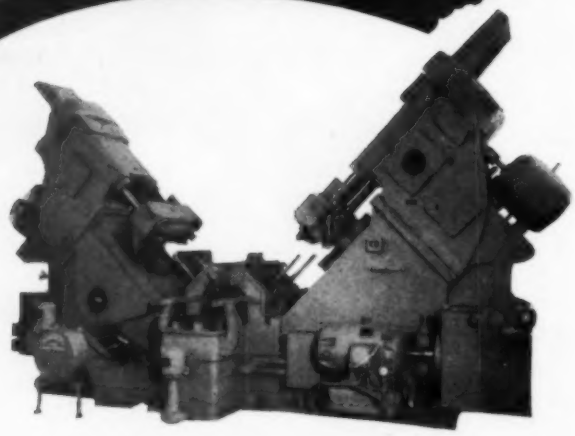

Photo Courtesy of:
Barnes Drill Co., Rockford, Ill.

THE Barnesdril Duplex Angle Type Honer #320 illustrated above, especially designed to meet the high-production requirements of one of America's leading automobile manufacturers, is a vivid example of the wonders of modern machinery.

Its operation is similar to other honing machines in which the honing process is accomplished by the simultaneous rotation and reciprocation of a tool incorporating a number of honing sticks and stones of the proper grit and grade.

However, unlike older type honers which use a ratchet or screw to control the expansion and contraction of the tool, Model 320 uses a Greer Accumulator and a hydraulic cylinder indirectly operating a pushrod to accomplish this operation at the greatly accelerated speed so important for high-production honing.

This rapid expansion and contraction of the tool is made possible by the Greer Accumulator which stores fluid during the comparatively slow work cycle and then releases it instantaneously in large volumes during the expansion and contraction cycle. The accumulator also makes it possible to use a much smaller pump to obtain the necessary large volume of oil.

By redesigning your own process or machine to incorporate a Greer Accumulator, you too can cut unit cost, save floor space and increase production.

Our Bulletin 301 "Hydro-Pneumatic Accumulators" describes in detail the construction features and industrial applications of Greer Accumulators. Write for your copy on your company letterhead.

GREER HYDRAULICS INC. • 456 18TH STREET : BROOKLYN 15, N. Y.
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Circle 19 on Reader Service Card

in your Journal, we should be very much obliged if you could let us have their addresses, or if possible that of their English agents.

F. M. B.

The addresses of these companies are: W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa.; Hannifin Mfg. Corp., 1103 South Kilbourn Ave., Chicago 24, Ill.; Logansport Machine Co., Inc., 40 Payson Road, Logansport, Ind. Our records do not indicate if any or all of these companies have English agents; they will be able to advise you directly.

You published the J.I.C. Pneumatic Standards for Industrial Equipment in the April issue of APPLIED HYDRAULICS. Would it be possible to secure a copy of these Standards in booklet form? You also refer in your column to a Data List. Your and the reader's comments concerning its contents induce me to request a copy when it is ready for distribution.

J.J.T.

The J.I.C. Pneumatic Standards for Industrial Equipment is available in booklet form from J. C. Rauss, General Motors Corp., Product Engineering Section, 15-228 General Motors Bldg., Detroit 2, Mich. or from Miller Motor Company, 4027 N. Kedzie Ave., Chicago 18, Ill. The new APPLIED HYDRAULICS Data List is in the process of being printed and we expect it will be ready for distribution in a few weeks. The new Data List is considerably longer than the current edition and will include complete J.I.C. Hydraulic and Pneumatic Standards for Industrial Equipment.

I am trying to contact the manufacturer of certain types of air control equipment some of which goes under the trade name of "Conoflow". Can you help us.?

R.M.

The manufacturer is Conoflow Corporation, 2100 Arch St., Philadelphia 3, Pa.

We would like to remind our readers that the MIT short course in the Fundamentals of Hydraulic Power Control will be given from July 9 to 20. At our last contact there were still places open. Essential facts on the short course were given on page 30 of the May issue. For a reservation in the short course write or wire Professor Walter H. Gale, Director of the Summer Session, Room 3-107, Massachusetts Institute of Technology, Cambridge 39, Mass.

Stop High-Pressure Leaks and Blow-offs

—with ANCHOR Ductile Sleeve Hose Couplings

Factory application of Anchor's exclusive Ductile Sleeve Coupling is your best insurance against leaks or blow-offs. Our superior grip gives you a plus margin of safety and a minimum time loss due to lay-up of equipment.

Here's how it works (referring to the illustration): Cover stock (G) is removed from the hose by grinding and buffing. Ductile Sleeve (C) is slipped on the end of the hose over the bare wire. Coupling body (A) with steel insert (B) attached is placed in position on the hose. The coupling is then swaged radially on the hose, imbedding the ductile sleeve into the internal grooves of the coupling shell (E) and into the mesh of the wire braid reinforcement (F). This is the exclusive Anchor patented grip.

Some of the applications of Anchor high-pressure flexible oil lines include high-pressure riveting, road machinery, snow plows, coal mining machinery, material handling machinery, machine tool applications, agriculture, railroads, oil field machinery, liquefied petroleum gas, lubrication and various other installations.

Clamp-type Couplings

2-Piece Re-usable Couplings

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Other styles of related fittings available for piping installations

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- made in wide range of shapes and sizes.

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LITERATURE AND SERVICES OFFERED IN THIS MONTH'S ADS

CONTROL FOR AIR CYLINDERS is supplied by two new hand and foot valves described in available Hannifin bulletins.

Circle 56 on Reader Service Card

"O" RING ENGINEERING DATA is offered by the Plastic and Rubber Products Co.

Circle 37 on Reader Service Card

SOLENOID VALVES for direction flow control to 150 psi are described in Bulletin 493 offered by Skinner Electric Valve Division.

Circle 43 on Reader Service Card

REUSABLE HOSE ENDS are the subject of Catalog H-1451A available from The Weatherhead Company.

Circle 30 on Reader Service Card

"CONTROLLED AIR POWER DEVICES" are described in literature offered by The Bellows Co. Photographs, technical data, case histories and circuit information are given.

Circle 10 on Reader Service Card

MANUAL 4-WAY VALVE built by Gre-Sen Manufacturing Company is described in available data sheets.

Circle 59 on Reader Service Card

COUPLING SELECTOR CHARTS are included in Loveoy Flexible Coupling Company's catalog.

Circle 73 on Reader Service Card

SUNIVS 900 OILS is the subject of an illustrated booklet giving physical properties and application data.

Circle 52 on Reader Service Card

MOLDED PACKINGS for air and oil applications are listed in a catalog prepared by Periflex Inc.

Circle 66 on Reader Service Card

FLOW CONTROL VALVE for cylinder speed adjustments is detailed in an illustrated circular offered by Pneu-Trol Devices, Inc.

Circle 54 on Reader Service Card

CYLINDERS with new cartridge type packing gland are shown in engineering data sheets available from Petch Manufacturing Company.

Circle 50 on Reader Service Card

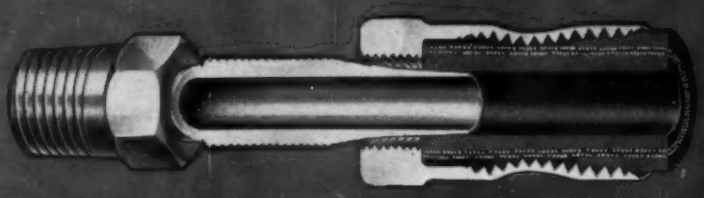
(Continued on page 30)

WEATHERHEAD

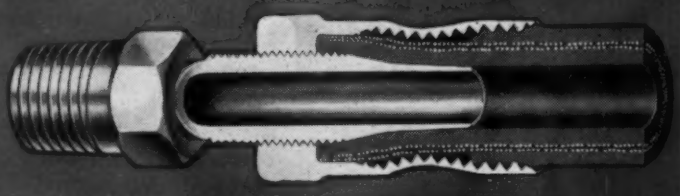
REUSABLE HOSE ENDS AND HEAVY-DUTY HOSE

permit quick make-up of flexible lines from stock

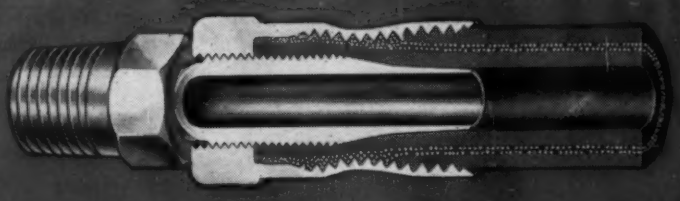
No longer need design changes make flexible hose line inventories obsolete. Make up what you need to any length to meet every pressure demand—from standard hose and *Weatherhead All-Steel REUSABLE HOSE ENDS.*



1. Hold hex of body (right) in vise. Turn hose into body (left-hand thread) until end of hose barely bottoms in end fitting.



2. Lubricate the insert (left) and the inside of the hose end with oil . . . thread insert into body.



3. Tighten the insert until the hex of the insert shoulders on the body. (Body has left-hand thread so that tightening effects seal both inside and outside of hose.)

Quick and easy—any length; meets every pressure demand; low, medium, medium-high and high. Figure for yourself the inventory savings when you simply stock random lengths of hose plus the proper sizes of REUSABLE ENDS.

WRITE FOR DETAILS—get new catalog No. H-1451A. Address The Weatherhead Company, Dept. A, 300 East 131st Street, Cleveland 8, Ohio.

FIRST IN HYDRAULIC CONNECTIONS

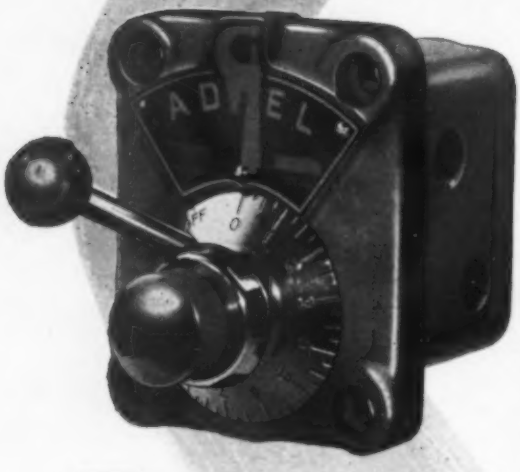
WEATHERHEAD

Plants at Cleveland, Ohio; Angola and Columbia City, Indiana; and St. Thomas, Ontario

The Mark of Quality

THE NEW ADEL

FLOW CONTROL VALVE FOR VERSATILITY



Adjustable from completely shut off position to 25 G.P.M. maximum flow. Will maintain constant fluid flow and constant machine feed over a wide range of pressures and feed resistances.

The diagrams show but two of innumerable circuits and systems where this versatile and better valve can be used to advantage.

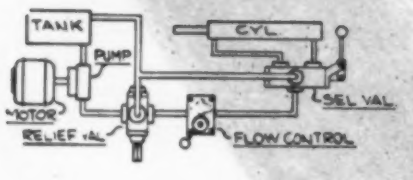


Diagram illustrates typical circuit showing control of cylinder.

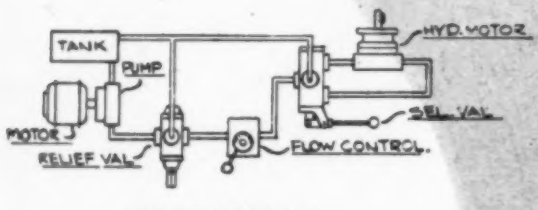


Diagram illustrates typical circuit showing control of hydraulic motor.

8 model variations are available—⅜ in. Pipe Size—1, 2, 4 & 6 G.P.M. Flow Max.

⅜ in. Pipe Size—10, 15, 20 & 25 G.P.M. Flow Max.

CHARACTERISTICS

1. Valve is compensated type which maintains substantially a constant flow regardless of variation in inlet and outlet pressure.
2. Maximum recommended inlet pressure 1500 P.S.I.
3. Maximum recommended outlet pressure equals inlet pressure minus 100 P.S.I.
4. No drain line required.
5. Wide range of control lever rotation (270°) permits extremely accurate flow settings.

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For complete engineering specifications and counsel, Address: ADEL DIVISION—GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

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Circle 31 on Reader Service Card

(Continued from page 26)

CATALOG 1250 offered by W. H. Nicholson & Co. illustrates their valves built for any pressure medium to 5000 psi.

Circle 46 on Reader Service Card

MILLER MOTOR COMPANY offers illustrated bulletins H-105 and H-104 which show their square design for air and oil cylinders.

Circle 7 on Reader Service Card

PYDRAUL F-9 a non-flammable hydraulic fluid is the subject of Technical Bulletin O-75 issued by Monsanto Chemical Company.

Circle 14 on Reader Service Card

FILTER, REGULATOR, LUBRICATOR assembly for the protection of pneumatic systems is described in literature prepared by M-B Products.

Circle 61 on Reader Service Card

HYDRAULIC PIPING NEEDS, for systems using hose, tube or pipe, are discussed in technical data compiled by L&L Manufacturing Co.

Circle 40 on Reader Service Card

METALLIC PACKING for hydraulic cylinders is shown on specification sheets drawn by Hydraulic Accessories Co. Dimensional data on the packing and gland design are shown.

Circle 72 on Reader Service Card

LEVER OPERATED VALVE for hydraulic service to 5000 psi is described in material available from C. B. Hunt & Son Inc.

Circle 71 on Reader Service Card

FILTER SPECIFICATIONS for your specific oil systems will be given by General Filters, Inc.

Circle 13 on Reader Service Card

FULFLO SPECIALTIES CO., INC. makes available the Fulflo Mechanical Data Book giving useful information on the construction and use of oil components.

Circle 57 on Reader Service Card

DENISON ENGINEERING CO. features a new solenoid controlled 4-way hydraulic valve. Specification sheets are available.

Circle 22 on Reader Service Card

SOLUTION TO ROTARY FITTING problems is given Catalog 50-C prepared by the Chiksan Company.

Circle 15 on Reader Service Card

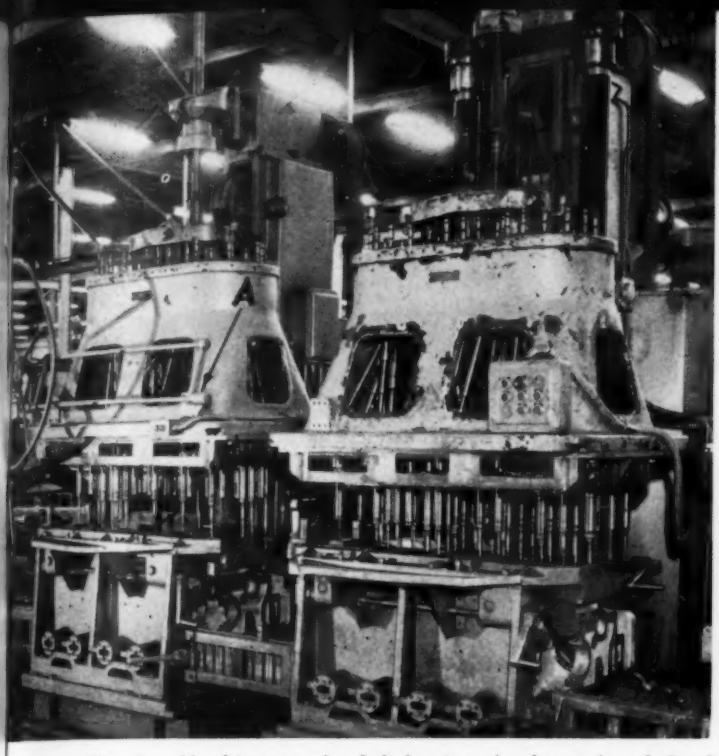


Fig. 1. Machine on the left having the large handwheel shows the general appearance before conversion. The machine on the right, after conversion. Note pad "A" to which the push button station has been attached. The two feed cylinders are mounted to a bracket at the top of the machine. The spindle drive gear box is mounted on top of the bracket.

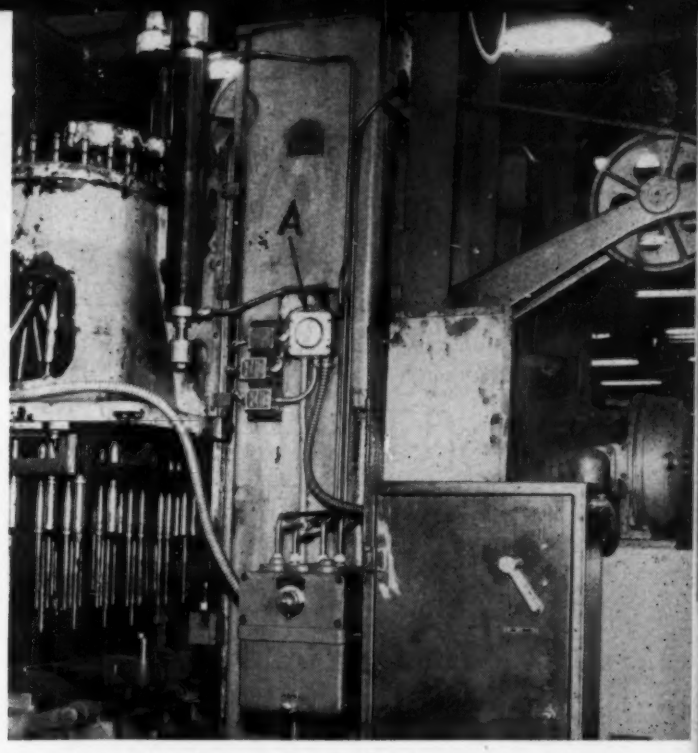


Fig. 2. Here is the completed job, showing the right side of the NATCO multiple drilling machine using hydraulic feed controlled by oil pressure directed to the cylinder by the valve panel. Operation of the solenoid actuated valve is obtained by the proper tripping of limit switches. Junction box "A" is on the end of the original power service conduit.

By W. T. McCORMICK

Revamp Your Drilling Machines To Make Production Records

HUNDREDS OF *NATCO* MULTIPLE DRILL PRESSES equipped with mechanically induced feed are still being widely used after more than twenty years of service. Characterized by their large hand wheel, Figure 1, for manually positioning the drill head, and a geared feed mechanism which offers only a limited selection of feed rates, these machines are very inefficient.

Since most of the NATCO machines have sound and serviceable columns and drill heads, we looked for a means of modernization that could be applied to all of these machines in our shop. This redesign was built around commercially available cylinders, 3 ½ inch bore, which have a true cylindrical shape and are offered in stroke lengths to 48 inches. These cylinders, which have no protruding bosses permit the design of the holding bracket with small sized bores.

The main bracket was designed to mount on top of the column, between the joint faces of the column and spindle speed gear box. It is of welded construction and a modified "Y" in shape, each arm being bored and faced to receive a cylinder adapter. Three types of cylinder adapters

W. T. McCormick is a Machine Tool Builder with Caterpillar Tractor Co.

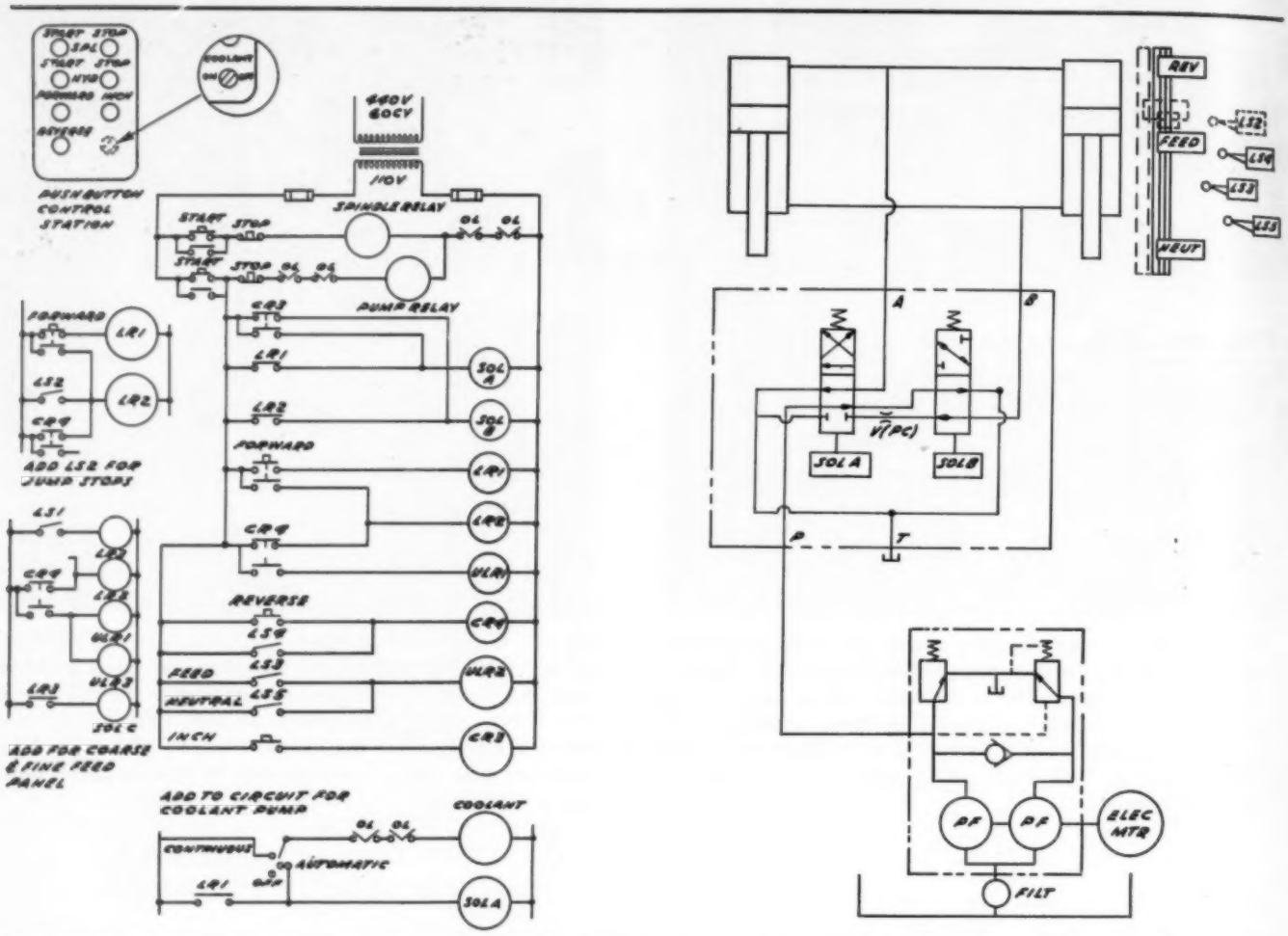


Fig. 3. Electric and hydraulic circuits. Dotted lines at the limit switch group are for jump stops or second feed. Rapid forward—Sol A and B energized; Feed—Sol A energized B deenergized; Neutral—Both solenoids deenergized.

were designed, to meet variations in application and cylinder lengths.

In order for hydraulic force to be applied to the drill head at the same point that mechanical force had been applied, the old mechanical feed pinion and shaft were removed and replaced by a suitable shaft, threaded on each end to receive an eye. Figure 2 clearly shows a cylinder fastened to the main bracket with its piston rod end fitted into the eye of the new shaft.

To complete this conversion with a minimum of machine down time, an all electric system of control was incorporated. A solenoid operated 4-way valve with pressure open to tank through cylinder port A and cylinder port B blocked when the panel is in neutral position, eliminates the necessity of using a resistance valve to prevent the drill heads from falling by gravity. Built into the same housing with the 4-way valve is a flow control valve which provides stepless feed.

Hydraulic energy is generated by a double pump with built-in combination valving, providing 11 gpm volume at a pressure of 225 psi developing 4330 pounds force and 140 inches per minute rapid traverse; and 1 gpm at a maximum of 1000 psi feed pressure, for developing 19,240 pounds force.

No automation such as this would be complete without the safety of a positive stop. The stop used is unique in design in that it was a small saddle containing a rack of the same pitch as

(Continued on page 72)

Greater feed range, reduction of operator fatigue and savings in maintenance are the results of converting a twenty year old drilling unit to hydraulic operation.

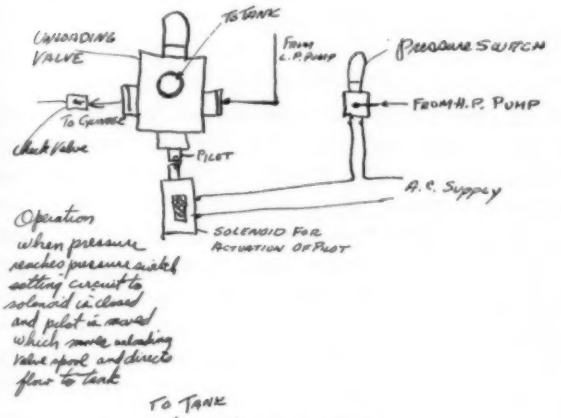
HERE'S HOW

- PREVENTIVE MAINTENANCE
- SERVICE PROCEDURES
- MODERNIZATION
- SHORT CUTS

Electrically Actuated Unloading Valves

IN A TWO STAGE SYSTEM WHICH HAS A HIGH pressure pump and a low pressure pump, it is often undesirable and expensive to use the high pressure to actuate the pilot of an unloading

FIG 1


UNLOADING VALVE
TO TANK
FROM L.P. PUMP
PRESSURE SWITCH
FROM H.P. PUMP
To Gauge
Check Valve
PILOT
A.C. Supply
SOLENOID FOR ACTUATION OF PILOT
Operation when pressure reaches pressure switch setting circuit to solenoid is closed and pilot is moved which moves unloading valve spool and directs flow to tank

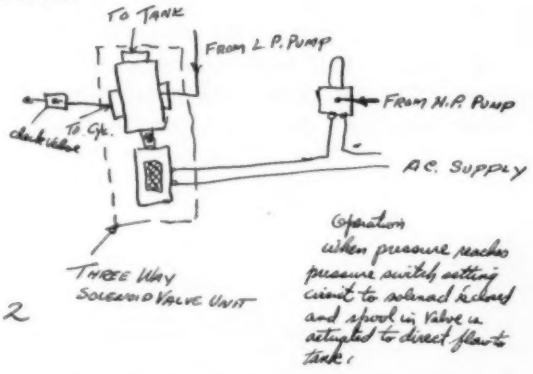

TO TANK
FROM L.P. PUMP
FROM H.P. PUMP
To Gk.
Check Valve
A.C. Supply
THREE WAY SOLENOID VALVE UNIT
Operation when pressure reaches pressure switch setting circuit to solenoid is closed and spool in valve is actuated to direct flow to tank.

FIG 2

valve, which unloads the low pressure pump. This is especially true when the high pressure pump is of 5000 psi or higher fluid pressure, because the pilot piston must be of precision fit; thus very expensive. To get around this, a pressure switch in combination with a solenoid can be used with a low pressure unloading valve as shown in sketch 1 or a pressure switch in combination with a solenoid operated unloading valve can be used as shown in sketch 2.

WOODROW L. WROBLE
Schenectady, N. Y.

Accurate Tension Control of Rewind Rolls

A SIMPLE APPLICATION OF SHOP AIR TO THE tension control on rewind rolls has reduced machine downtime due to material breakage and has resulted in substantial savings in material.

The operation involves stripping of cast vinyl film from a supporting sheet. This stripping operation requires very close control of tension with fine stepless adjustment to take care of variations in material thickness and shop conditions of temperature and humidity which affect the rolling.

Tension on the rolls is controlled by adjusting the pressure between the faces of a friction clutch. Originally the machine was built with a clutch which was controlled by spring pressure manually adjusted by a handwheel. Such control was erratic; the operator had no sure method of adjustment.

This inadequate control was replaced with air cylinders which exert pressure on the friction faces. The operator quickly and smoothly controls the tension by using a valve to vary the shop air line pressure to the cylinders. Pressure gauges on the air regulator give a definite measuring stick of the slip in the clutch and resultant torque delivered to winding roll.

C.J.S.

Common Exhaust Manifold Causes Timing Trouble On Air Operated Machines

WE OPERATE A BATTERY OF FAIRLY COMPLIcated electrically controlled air-operated machines which go through a closely controlled cycle. All these machines exhausted into a large diameter pipe serving as an exhaust manifold whose diameter had been set up to be more than adequate. However, from time to time, the machines showed inexplicable variations in their cycle. These timing changes could not be traced down to any particular component of the machines.

We finally found that the light back pressure existing in the exhaust manifold from the operation of different presses was sufficient to occasionally interfere with the valving of some of the presses and thus produce this irregular operation. By disconnecting all these machines from the common exhaust manifold and exhausting them individually to the atmosphere, we obtained greatly improved performance.

P. H. WINTER
Syracuse, N. Y.

Production rates must be high to warrant building special automatic machines. This automotive application is a "natural" and will give you ideas of what can be done with oil power to provide "automation".

2400 Tubes An Hour

. . . on a chamfer and expanding machine

ON MILLIONS OF AUTOMOBILES ON THE ROAD today there are hydraulic shock absorbers which have as an integral part a length of welded steel tubing serving as the oil reservoir. One design requires a 20 degree chamfering operation on both ends of the steel tube to provide a lead for the pressfit of endcaps; and the tube also requires expansion at both ends to give pressfit diameter size.

This is a part which obviously requires high production and low unit cost and warrants construction of a special purpose machine.

An oil powered, completely automatic machine, which performs the chamfering and expanding operation on 2400 tubes per hour, has been developed and built by Pathon Manufacturing Company of Cincinnati. Once the machine is set in operation, it is only necessary to supply tubes to a gravity hopper which feeds the tubes into the machine index head, where the work is performed, and from which the part is then discharged down a chute into a carry-away truck.

Prior to the machine's construction, production required the use of a battery of lathes for chamfering, and punch presses for the expansion operation. Not only have valuable standard machine tools been released and man-hours saved, the new machine has done away with costly

Tubes are fed from a hopper (not shown) down the two guides into the eight station index head. Clamp cylinders act to firmly hold the tubes in the index plates, and then the chamfering and expanding tools move in from both sides to perform the work operation. Automatic indexing and movement of the work heads is controlled by limit switches.

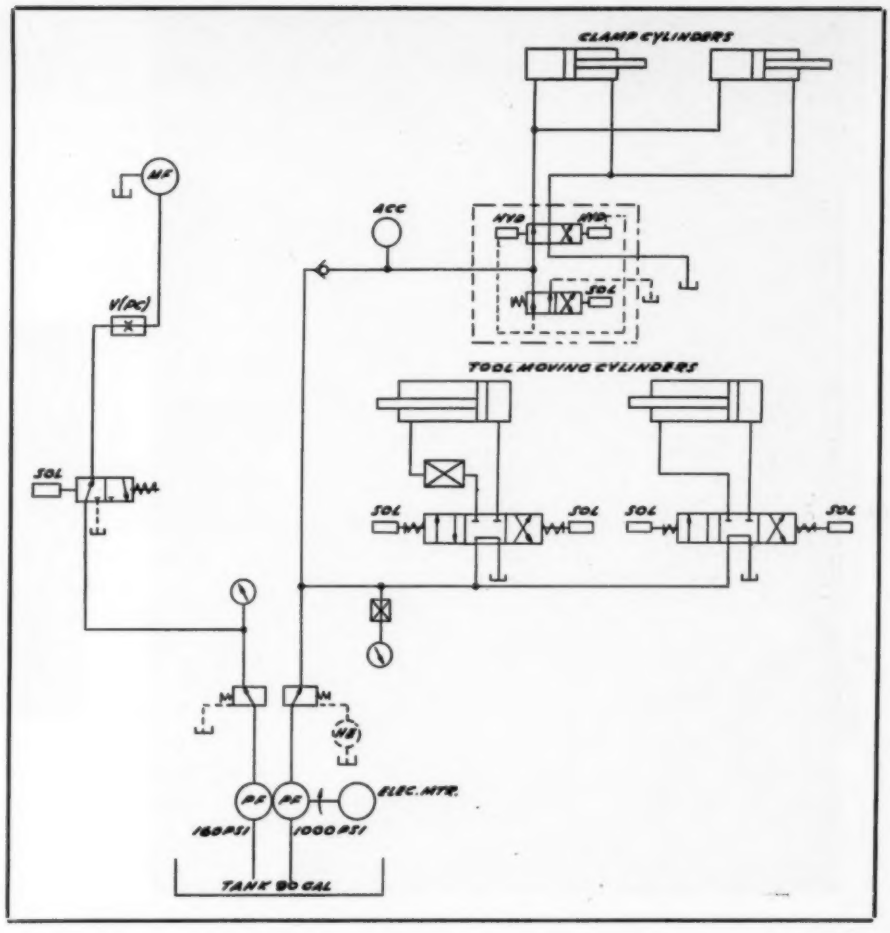
handling of parts.

Only one diameter of tubing, approximately 1 5/8 o.d. x 3/64 in wall, has to be accommodated by the machine. But the design requires handling tubes of various lengths from 5 to 13 inches. Adjustment for the variation in tube lengths is easily made by spreading apart the two index heads which move on machined ways. A casting, bored to take the spindle of the electric motor driven chamfering tool and also bored to hold the tungsten carbide expander tool. is mounted behind each index head.

There are two sets of machined ways. On one set, each entire assembly of index head, chamfer and expanding heads, and screen guards are positioned and locked by hand to suit a particular tube length. On the second set of hardened ways only the castings holding the chamfer and expand tools are moved in and out by the action of hydraulic cylinders when work is performed.

When the index plates are filled with tubes, after each 1/8 turn of the index plate a tube is loaded, at station 1, chamfered at 2, expanded at 5, and unloaded at 6. Stations 3 and

(Concluded on page 71)



Supplied by a two-stage vane pump, oil power moves the clamping cylinders, the work head cylinders, and a rotary fluid motor which powers the Geneva indexing mechanism.

Complete cycle of operation is shown on this bar graph. White blocks indicate the normal LS position and cross hatched blocks indicate periods of actuation. Note that while setting of the limit switches determines sequence of movement, the limit switches provide for safe operation. Failure to properly trip a LS will stop the machine.

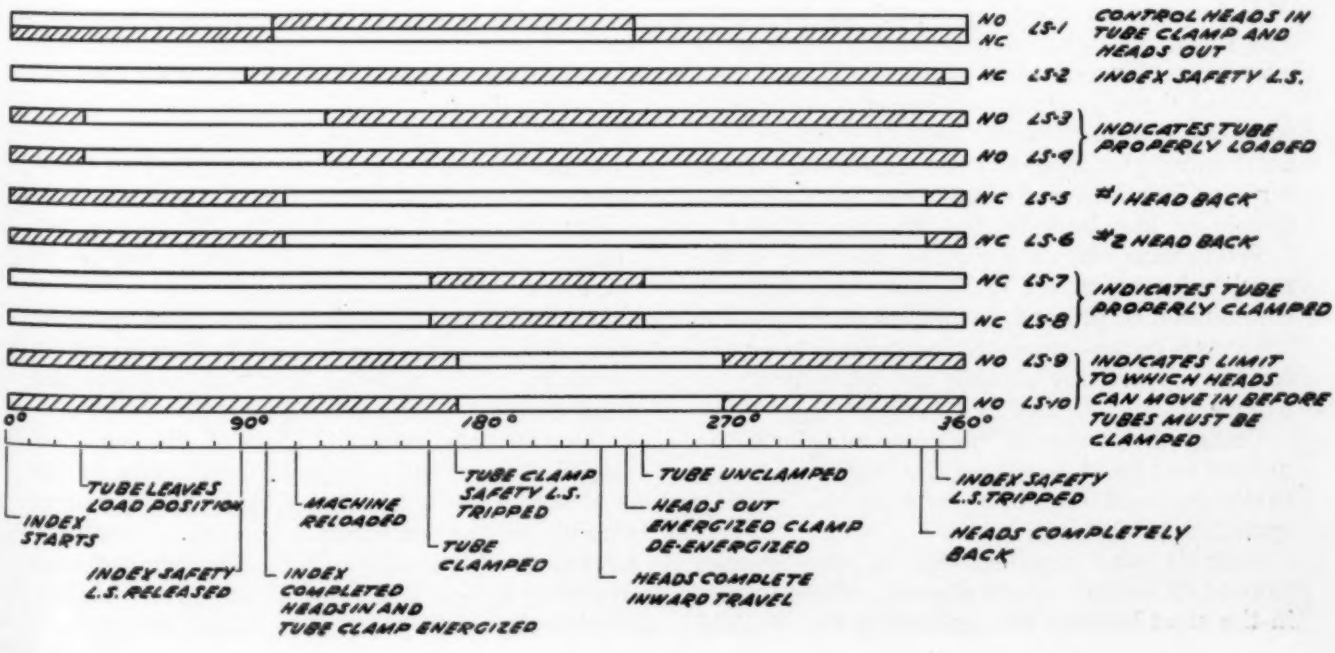


Fig. 1 The gear shaper shown in operation at Caterpillar Tractor Co., has cut the teeth on a Motor Grader gear.

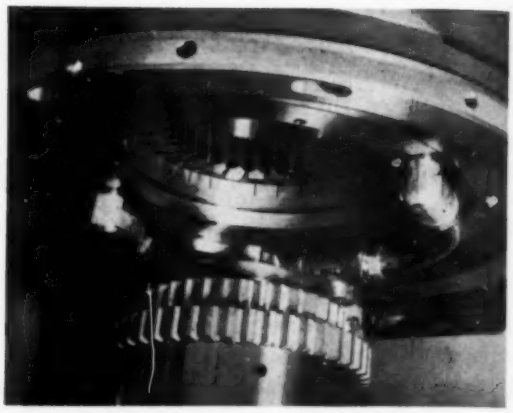


Fig. 2. Individual tool blades feed radially inwards a few thousands during each reciprocating stroke of the work through the cutter head.

Cut More Gears at Lower Unit Cost

WHILE GEARS AND SPLINES, HAVE LONG AGO become an accepted means of transmitting rotary motion, efficient tooth cutting is an ever present production problem.

About three years ago, to speed up output of some 50 different parts used in their line of earthmoving equipment, the Caterpillar Tractor Co. installed a Shear-Speed gear shaper, developed and built by the Michigan Tool Co.

Production economy on this machine is the result of cutting all teeth simultaneously. A comparison of production results at Caterpillar shows an output seven times greater over the former method for cutting the gear shown in Figure 1.

Using oil power to position and lock the unique tool head, to clamp the work and to actuate the feed clutch, speeds up the cutting cycle.

Here is what happens during the average time of 40 seconds which elapses between pushin the start buttons and unloading the finished gear seen in Figure 1.

Solenoid A is energized to shift pilot-operated, 4-way valve E2 directing oil from the double vane pump to move cylinders H and G, lowering the tool head and clamping the work. When the tool head has moved down into cutting position, a limit switch is tripped to energize solenoid B of valve E2. Oil goes to cylinder J to clamp the tool head. There are two clamp cylinders J, one of which is shown in Figure 5.

After clamping pressure becomes greater than 300 psi, sequence valve F3 opens to admit pressure oil to cylinder K which engages the feed clutch.

As the gear is cut, Figure 2, the ram on which the work is mounted, reciprocates in the tool head. At the bottom of each return stroke, the blades are fed radially inward in small increments by the action of a cone-shaped cam working against the heel of the cutter blades. At the top of the stroke the blades are slightly

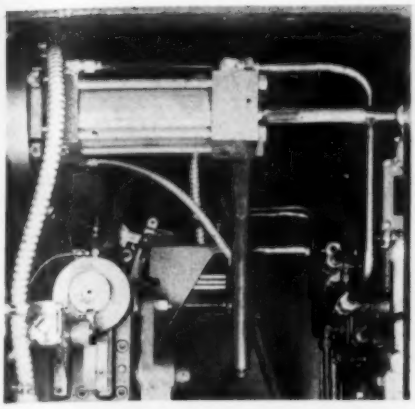


Fig. 3. Locking of the cutter head is done with a pair of cylinders. The piston rod trips a limit switch to energize a solenoid operated valve.

restricted by another cam to prevent drag on the return stroke.

The amount of infeed of the blades is progressively reduced after each stroke to equalize the cut, and the rate of change of feed is controlled by a ratchet mechanism which turns a cam.

When the gear has been cut to size, solenoid B is deenergized and C is energized to disengage the clutch cylinder K and release the head lock cylinders J. When the head lock cylinders retract they trip limit switches to deenergize solenoid A and energize solenoid D to return the cutter head to its up position and to release the work clamp.

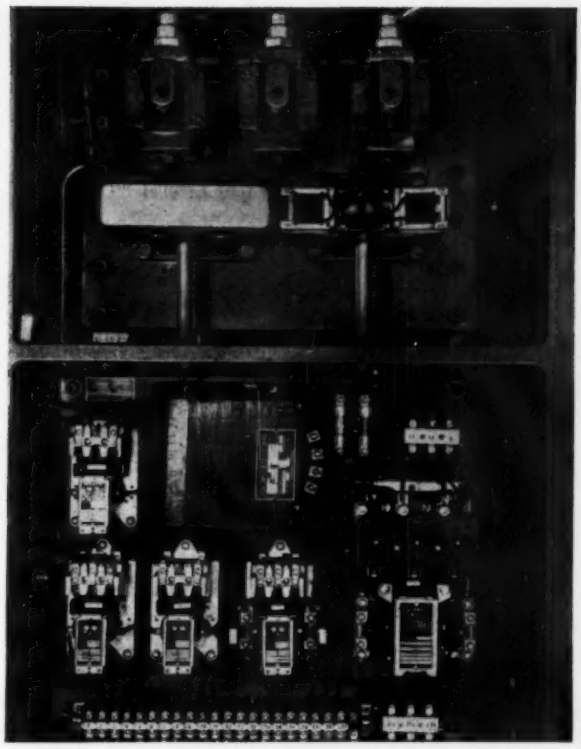
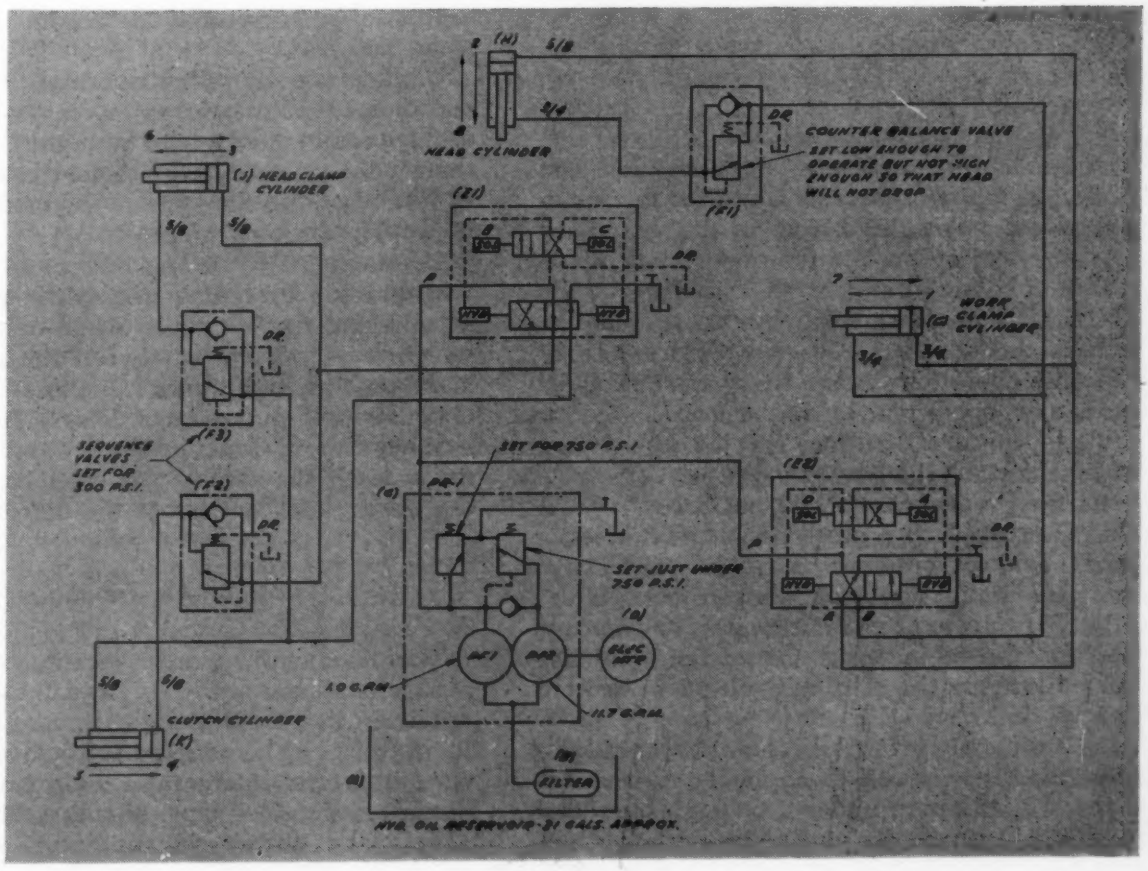


Fig. 4. Centralization of hydraulic valves and electrical controls offers quick accessibility for adjustment and repair.

Fig. 5. Hydraulic power is used to position and clamp the cutter head, clamp the work and engage the feed clutch. All piping is preformed and designed to insure correct connections for safe maintenance of equipment.


HEAD CYLINDER
COUNTER BALANCE VALVE
SET LOW ENOUGH TO OPERATE BUT NOT HIGH ENOUGH SO THAT HEAD WILL NOT DROP
HEAD CLAMP CYLINDER
WORK CLAMP CYLINDER
SEQUENCE VALVES SET FOR 300 P.S.I.
SET FOR 750 P.S.I.
SET JUST UNDER 750 P.S.I.
CLUTCH CYLINDER
FILTER
HYD. OIL RESERVOIR-31 GALS. APPROX.

Data and Photos
Courtesy of Compressed Air and Gas Institute

Fig. 1. Between presses, which perform trim and flanging operation, is positioned this "flare removal" table, designed at Truscon to use air power in a squeezing operation.

Part changes after a production line is set call for tooling ingenuity to keep parts flowing with a minimum of handling. At the Pressed Steel Division, Truscon Steel Company . . .

Special Air Fixtures Solve Press Lin

When presses are grouped and set up to expedite handling of parts, as in the production of refrigerators, a slight model change might cause costly delay somewhere along the line. Methods engineers must consider several possible tooling additions. Possibly the part can be re-routed to a press setup for the job, a new press might be added to the group, or costly re-tooling for the job undertaken

One of the least expensive procedures is the fabrication of special fixtures which can be either attached to presses for performance of the new operation during the press strike for a regular operation, or the fabrication of a table-top fixture that does the job somewhere along the press line.

At the Pressed Steel Division, Truscon Steel Co., Cleveland, the press department does a great deal of jobbing work for nationally known manufacturers of refrigerators. Naturally the problem of model changes is a constant one and the engineering staff of the plant has solved it many times by designing and making special fixtures.

In practically every case, plant line air pressure, readily available throughout the press department through under-floor and overhead piping, is utilized for economical, efficient operation of such fixtures. Maximum pressure is about 100 psi.

In the production of refrigerator doors, Truscon found that the pieces leaving a cam trimming operation had a flare or slight bulge along their sides. A more perfect door could be had by removing this flare before the next, or flanging, operation took place.

Least expensive of the solutions to this problem was the designing and fabrication of an air-powered fixture, table-top in nature again, which was positioned between the trim press and flange press, Figures 1, 2 and 3. The flared door is placed on the steel table, a foot-control lets air into an 8-inch cylinder, and two arms underneath the table push steel bars against the flared sides to correct the defect.

Cost of Air Tooling

The distance these steel bars move upon application of air power is adjustable through large screws placed along their lengths. Thus the fixture can be adapted to remove flares on several sizes of refrigerator doors, as commonly run in a jobbing shop of this nature.

Typical of the special fixtures is a table-top

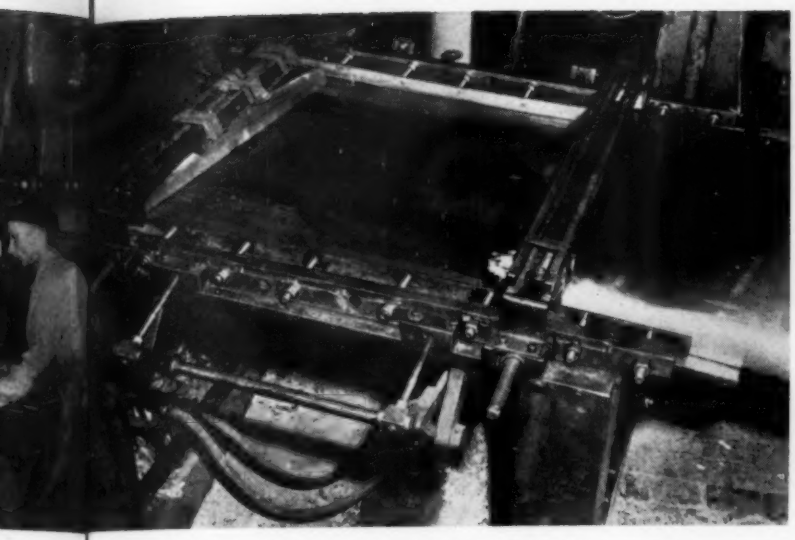


Fig. 2. Closer view of the table side bars, the space between which is regulated by series of screws. Arms that push bar, foreground, are shown extending from the rocker arrangement.

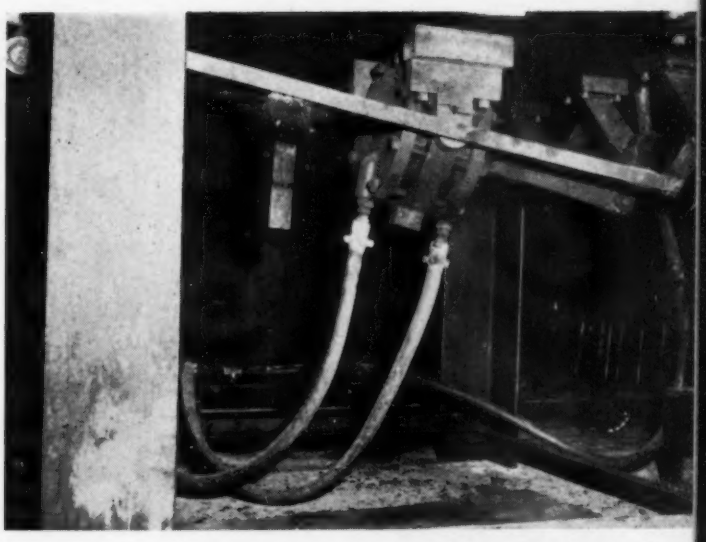


Fig. 3. Underneath the table, a standard air cylinder with hose connections from a three-way air pedal switch (out of view, left) actuates the rocker arm to power both sides of fixture.

Lin roblems

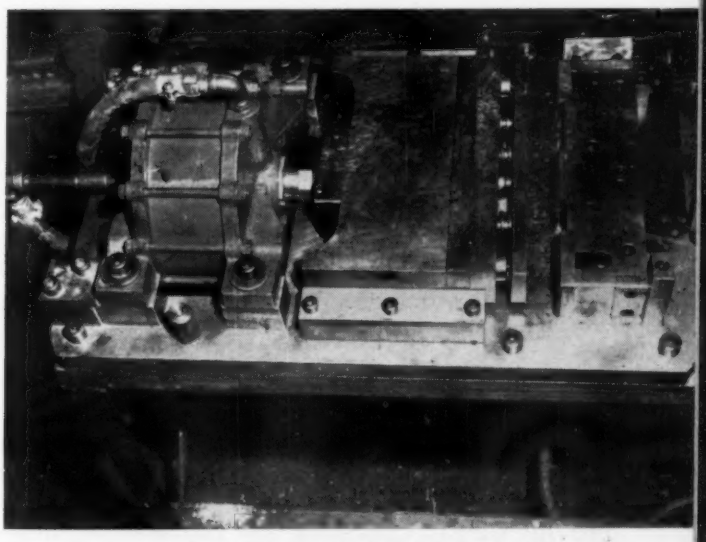


Fig. 4. Top and side view of a table-top fixture for perforating and slotting a refrigerator panel, end of which is shown, right, with holes. Springs around punching tools strip steel from the punches upon operation of the air controls.

set-up for perforation of two ends of a lower refrigerator panel, Figure 4. From designing on through fabrication and inclusion of standard, purchased parts, this fixture cost about $1600. Some of this cost can be written off as groundwork for similar air-powered fixtures. On the whole, this cost compares favorably with that of any other method of keeping a production line intact without undue expense.

In fact, the essential structure of the table, welded and bolted up of angle iron, can be used with interchangeable tooling on the top. Standard air cylinders, varied in diameter, function along with stripping springs to operate the perforation tools, or punches made of tool steel.

When the refrigerator part is placed in the fixture, a foot control commonly is used to permit air to flow into and operate the cylinder, hence the piston powering the perforating or whatever operation is being done. Three-way air switches are incorporated in the controls. The springs around the punches simply strip them from the steel part when air pressure is released from the cylinder.

A third example of fixtures built specially to meet a part modification is one built at Truscon for attachment to a press brake, right or left hand end, for perforation of four holes in the bottom of the same refrigerator doors described previously. The punching tools in this fixture, in relation to the air-powered ram, are set up exactly as detailed in the table-top fixture that also perforates.

In the instance of use with the brake, however, we find that the brake strike, while performing other operations (two workers are handling doors at the machine), also activates the air-powered fixture on the side. Thus three different operations on a refrigerator door are performed every time the brake is closed.

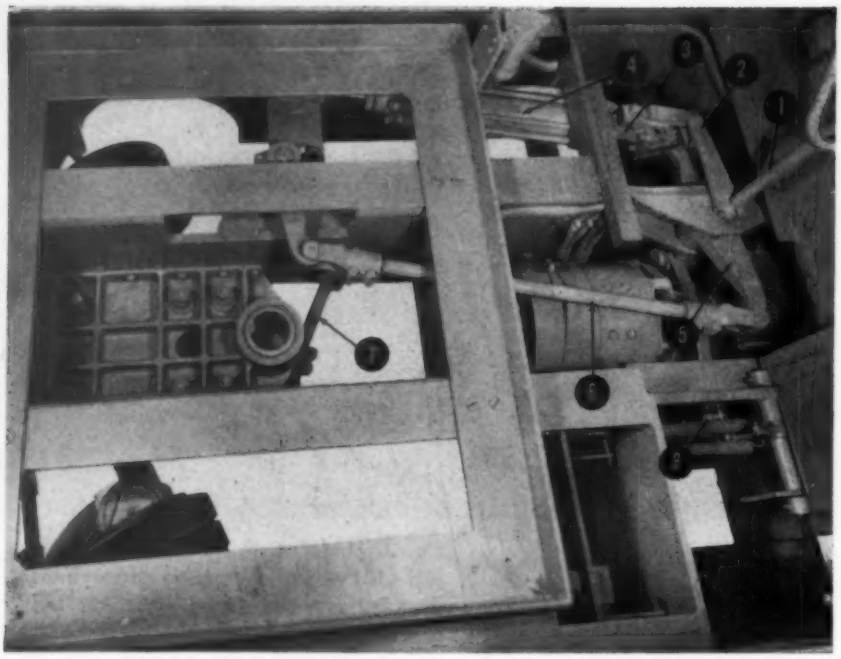


Fig. 1. Hydraulic booster steer used on Baker 8,000 to 20,000-pounds capacity fork trucks. Shown are (1) steering post, (2) steering post lever arm, (3) self-metering valve, (4) hydraulic cylinder, (5) bell crank, (6) quad rod, (7) drag link to tie rods, (8) booster-pump motor switch.

Hydraulics Does the Work of Steering He

By R. H. DAVIES

BECAUSE OF THEIR SIZE AND WEIGHT, HEAVY-DUTY fork trucks present a problem in the design of steering units. Not only must these units provide ease of operation and fast steering action but they also should be free of the involved mechanisms associated with electro-mechanical units. To achieve these objectives, the Baker Industrial Truck Division of the Baker-Raulang Company, Cleveland, Ohio, employs the direct and the booster type electro-hydraulic steers in its heavier capacity trucks.

The hydraulic booster steer makes possible finger-tip control of heavy duty fork trucks from 8000 to 20,000 pounds capacity. When the operator moves the steering wheel, the movement is transmitted through a lever arm and actuates a control valve in the steering booster. This control valve directs the hydraulic oil to the booster cylinder producing a linear movement of the cylinder in the desired direction.

As shown in Figure 1, this double-acting cylinder consists of a piston attached to the truck frame and a cylinder coupled to a bell crank. Action of the cylinder moves the bell crank and transmits the steering motion to a quad rod which is connected to the steering wheel tie rods.

The normal force applied to the steering wheel automatically produces the amount of thrust necessary for all steering requirements. A self-metering valve at the coupled end of the cylinder by-passes the oil when the steering wheel reaches a stationary position selected by the operator for a certain amount of turning action. A switch located beneath the operator's platform controls the motor for the booster pump so that the motor operates continually while the operator is on this platform. A vane-type pump delivers oil at a pressure of approximately 1000 psi. Other hydraulic operations on the truck are powered by separate pump and motor.

A number of advantages result from the use of this booster steer. An example is the ease with which wheels can be turned from one extreme position to the other while the truck is standing. If the usual manual steering mechanism were used on a truck of 8,000 pounds capacity, the truck would have to be in motion before the wheels could be turned—and then great effort

R. H. Davies is Vice President and General Manager of The Baker Industrial Truck Division of The Baker-Raulang Company, Cleveland, Ohio.

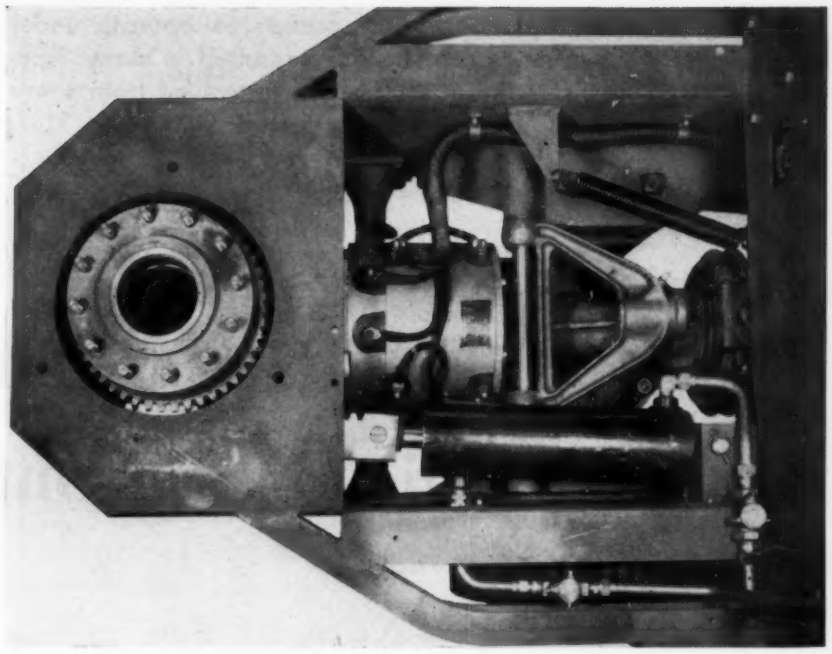


Fig. 2. Arrangement of steering unit components employed in the Articulated Truck. Not shown is the forward half of the truck, which fastens to the studs on the bull gear. Inside the bull gear is the pivot post. Notice the rack engaging the bull gear and the connection between rack and hydraulic cylinder.

Heavy-Duty Trucks

Fig. 3. Articulated Fork Truck has none of the usual steering connections. Both axles are fixed. Operator steers by rotating two halves of truck around a central pivot post. Lower frame and operator's platform are one half; forks, uprights, and battery compartment, the other.

would be needed. Other advantages of the electro-hydraulic steer are: smooth and quick steering action and freedom from steering shock.

In addition to these heavy duty fork trucks, Baker also manufactures a 4000 pounds capacity truck in which steering is accomplished by "articulating" or hinging the frame on a central pivot point. Hydraulics provides the power to do the articulating. With the use of this feature, two feet less aisle space is needed for turning than for a conventional truck of the same capacity.

The direct hydraulic power steer on the articulated truck employs a double-acting piston type cylinder actuating a rack and bull gear arrangement. The bull gear is fastened to the forward half of the truck while the hydraulic cylinder and rack are attached to the rear half. The components of this steering unit are shown in Figure 2.

Because the hydraulic steering cylinder requires a smaller volume of oil than the hoist cylinder a dual pump is used. The common shaft for this pump, which is of the gear type, is operated by a series shunt-wound motor capable of delivering constant speed under varying load conditions. While the motor operates, oil passes through both sections of the pump and by-passes to the reservoir through the control valve.

The steer pump motor does not operate unless steer control lever is moved. Articulating steering action continues until end of piston stroke is reached. To straighten truck or to turn in opposite direction it is necessary to reverse the piston by moving the handle in opposite direction. Operator can control speed of turning movement by metering the control valve with the control lever. Steer valve has a neutral return spring built into the plunger so that at the completion of the steering action the steering lever returns to neutral.

Increasing demands by industry for presses to operate under varying conditions in new processes have resulted in many "special" electrical circuits. These "specials" are evolved from • • •

BASIC ELECTRICAL CIRCUITS For Hydraulic Press Control

By K. B. REXFORD

HYDRAULIC PRESSURE FOR OPERATING PRESSES can be generated either by a variable or by a fixed delivery pump which is generally powered by a normal torque normal starting current a-c squirrel cage induction motor. The starting is accomplished by either a magnetic full voltage or reduced voltage starter, depending on the customer's power supply conditions.

One type of hydraulic operator, for actuating the pump, consists basically of a cylinder in which are located two or more pistons. As hydraulic pressure from a pilot source is applied to one or more of these pistons, they are caused to move in a predetermined direction. Being connected through a linkage to the pump control, they cause the pump output to be controlled in direction and volume.

1. This first basic electrical circuit consists of a minimum number of elements considered necessary for the safe and proper operation of a hydraulic ram in simple advance and return motion. The main valve solenoid is energized through contact R8-2 on relay CR-8. This relay is energized by the operation of two "FORWARD" pushbutton units, in a series circuit with several elements that are common to most of the circuits that will be discussed. It follows that the energizing of the "MAIN" valve solenoid starts the platen on its down or advance stroke. The de-energizing of this valve at any time will return the platen to its initial position.

The normally closed thermostat control (O.T.L.) (oil temperature limit) operates at a temperature setting of 125°F.

The normally open limit switch LS-5 is so located on the press that it will be operated to the closed condition only with the platen or slide in its top or start position. The function of this switch is to require the platen to return to its top or start position in each cycle before it may be operated to start the next cycle.

Around the two "FORWARD" buttons and limit switch LS-5 has been placed an interlock switch R8-1, to allow the operator to remove his hands from the buttons once the circuit has been set up. In some cases, as an additional safety precaution, this interlock has been removed or made optional by introducing a two-position selector switch in the R8-1 interlock circuit. With this interlock out of the circuit, the operator must keep both hands on the "Forward" buttons during a pre-determined part of the platen travel. The position of the platen when the operator may remove his hands from the buttons is determined by the position of limit switch LS-6, which in turn energizes relay CR-1 and interlock R1-4 takes the place of R8-1.

The circuit now is completed to the relay CR-8 by a N.C. limit switch P.R. (position reversal) and a N.C. pressure switch T.C. (tonnage control). The operation of either the position reversal limit switch or the tonnage control will de-energize relay CR-8 and, in turn, the main valve solenoid. This reverses the platen motion.

As reference is made to each succeeding Figure the basic circuit to that point is shown in broken lines and the added circuit in full lines.

2. The first addition to the basic circuit will be to provide conditions such that the press will continue to cycle after its initial start without operating the "FORWARD" buttons for each cycle.

With the FULL-AUTO—SEMI-AUTO selector

K. B. Rexford is an electrical engineer with The Hydraulic Press Manufacturing Company, Mount Gilead, Ohio.

switch closed on Semi-Auto, the operation will be the same as just described, as the added relay CR-15 cannot be energized.

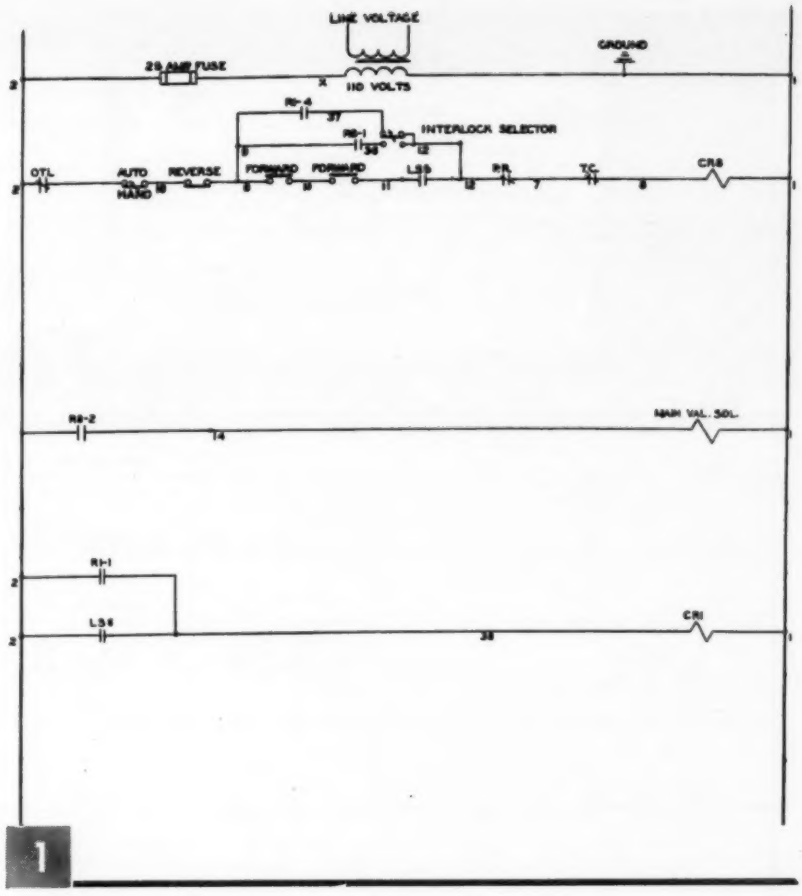
Closing the switch to "FULL-AUTO" allows relay CR-15 to energize with the initial operation of the "FORWARD" buttons. The relay interlocks through its own contact R15-1. Thus, at the completion of each advance travel of the platen, relay CR-8 de-energizes. When the platen completes its return travel and operates N.O. limit switch LS-5, the circuit is completed through relay contact R15-1 to re-energize relay CR-8 and start the cycle.

Speed Control of Ram

The next requirement that is considered on most applications is the control of speed in either the advance or return direction.

The introduction of additional solenoid valves makes it possible to control the pump stroke by introducing pilot pressure into different areas on the pistons located in the hydraulic operator previously described. The electrical circuit problem, therefore, is to control properly the energizing and de-energizing of these valve solenoids. This is accomplished through the use of limit switches, operated by the motion of the platen.

The operation of the "FORWARD" slow-down is obtained through energizing a R8-2 relay contact and one or more N.O. limit switches. The relay contact is closed at the start of the "FORWARD" or advance stroke. As the travel of the platen advances from its initial position to the completion of the stroke, the limit switch or switches are set at positions to energize the slow-down valve solenoid at the desired position. On the return or reverse travel of the platen, the Reverse Slow-Down solenoid may be energized by the closing of normally open limit



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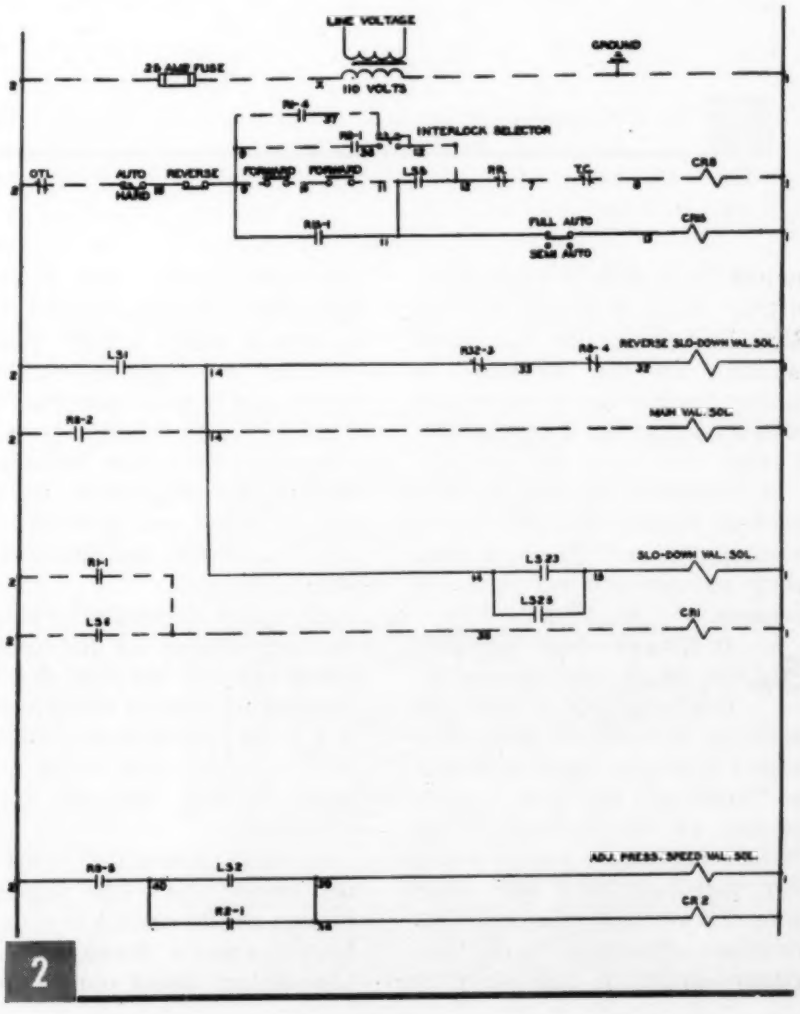

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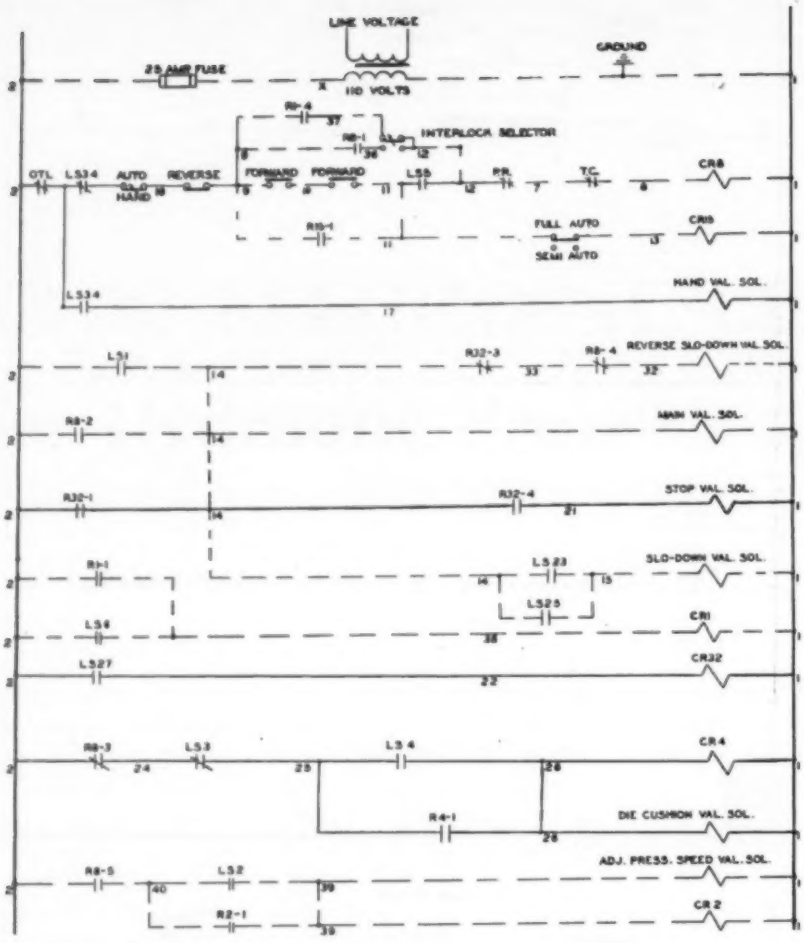


3

switch LS-1 at any desired position. Note that the Reverse Slow-Down circuit has been isolated on the advance or down stroke by a normally closed contact R8-4 on the CR-8 relay.

A variation of this type of control, known as "Adjustable Pressing Speed" also is used very extensively on drawing presses.

3. It is very often desirable to bring the platen to dead stop on either the advance or return travel. This action also may be referred to as "inching", and it is accomplished by the addition of the "STOP" solenoid valve, working together with the main solenoid valve to place the hydraulic operator on neutral position—bringing the pump to the zero stroke. The manual operation of limit switch LS-27 energizes relay CR-32, which in turn, through its contacts R32-1 and R32-4, energizes the "MAIN" and "STOP" valve solenoids. Note that these contacts are independent of the R8-4 contact, and therefore operate on either the advance or return stroke.

In many applications of hydraulic presses in the metal-working field, the use of a die cushion or ejector is required. A typical application of control that is often used with these units is the delayed action ejector.

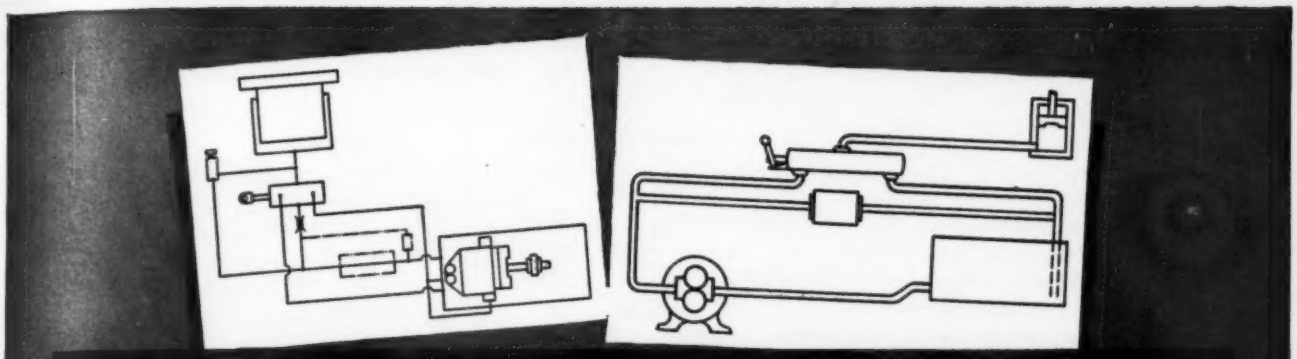
In this operation, there is no action on the advance stroke, as the circuit is isolated by a normally closed CR-8 relay contact being open during this time. When the platen reverses either by position or pressure, relay CR-8 is de-energized and R8-3 contact closes, setting up the ejector circuit. On the return of the platen, N.O. limit switch LS-4 is operated to the closed position energizing the ejector solenoid and relay CR-4 interlocking around the limit switch with contact R4-1. As the ejector ram now travels up ejecting the work, a N.C. limit switch LS-3 is operated, de-energizing the ejector valve solenoid and relay CR-4. The ejector now returns to the bottom or initial position for the next cycle.

In many cases the operator may want to operate the press from hand lever control. This type of operating is desirable in setting up dies. Through mechanically raising and lowering the control rod, the pump control is actuated and the press operation controlled. There are, however, two functions that are added in the electrical circuit to assist in this operation:

(a) The "Hand" solenoid valve is added, which, when energized, removes the pressure in the hydraulic operator that normally would oppose the motion of the control linkage. This permits hand operation with much greater ease. The valve solenoid is energized by N.O. limit switch LS-34 being operated by motion of the hand lever.

(b) In order to insure greater safety conditions, the N.C. contact of limit switch LS-34 is placed in the main control circuit in series with the "Reverse" switch such that at any time the press is being operated manually, the N.C. contacts of LS-34 are open, preventing the accidental operation of an automatic cycle.

Adapted from a paper presented at the 15th Annual Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corporation, April, 1951.



A Beginner's Course in Basic Hydraulics

Chapter VIII

HYDRAULIC PUMPS

Part 7

Axial Piston Pumps

When pistons are driven back and forth in their cylinders in a direction parallel to the drive shaft, this action is axial motion. While the pistons move outwards, oil is drawn into the cylinders. On the inward stroke oil is discharged to the system.

Compactness is a prominent design advantage which axial piston pumps have as compared to radial construction. However, while bulkiness has been reduced these pumps are mechanically more complicated.

Axial piston pumps have proven to be highly efficient with overall efficiencies of 90 per cent at rated loads; and they are extremely versatile in their ability to generate high pressures and deliver a wide range of volumes.

Precision workmanship and fine materials must be used in building these axial piston pumps to give a unit with rated pressures near the top requirements of present-day applications—3000 to 5000 psi. Slippage is very low, resulting in volumetric efficiencies of 95 per cent at rated operation.

The Vickers pump Figure 1, and the Denison pump Figure 2, illustrate two constructions of axial piston pumps.

Essentially the axial type pump contains a cylinder block assembly in which the pistons are equally spaced around the cylinder block

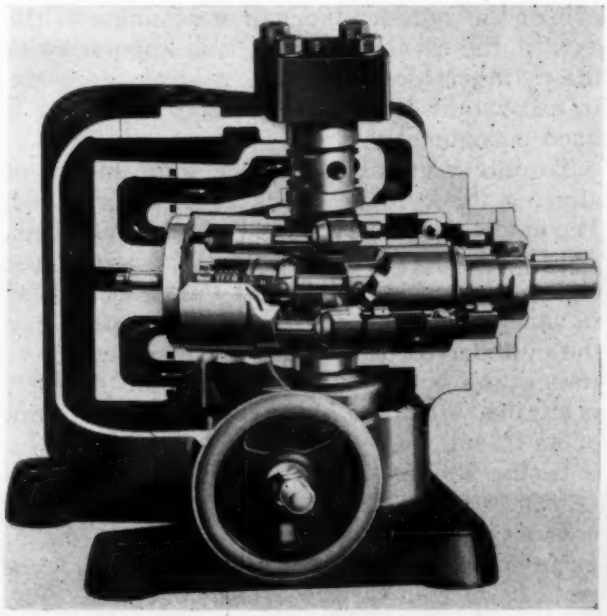


Fig. 1. Reciprocating motion of the pistons in this Vickers axial pump is caused by the cylinder block being positioned at an angle to the drive shaft. The pump delivery is a direct function of the angular setting of the block. Providing the handwheel to position the block makes this a variable delivery unit capable of delivering oil at pressures up to 3000 psi.

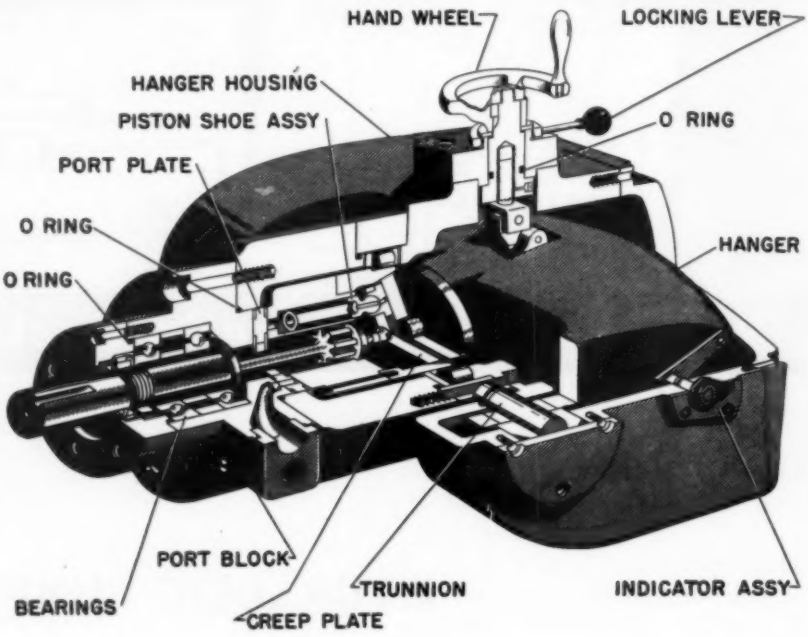


Fig. 2. Denison Engineering Company's pump uses a cam plate to transmit axial motion to the pistons. Variable delivery is accomplished by changing the angle of the cam plate. Pressure up to 5000 psi, generated at an overall efficiency of more than 90 percent is made possible by high quality workmanship and materials.

axis and the cylinder bores are parallel to the axis.

The cylinder block is connected to the drive shaft so that both the block and shaft rotate at the same speed. This linkage is clearly shown in both Figures 1 and 2.

Shift Entire Cylinder Block To Vary Pump Output

Examining the Vickers design, it is seen that the pistons rotate and reciprocate. They rotate with the cylinder block because both the block and pistons are attached to the driving member. The pistons reciprocate because the axis of the cylinder block is at an angle to the axis of the driving shaft. This angularity of the cylinder block determines pump delivery. In a constant displacement pump the angle is fixed permanently.

To obtain variable delivery some means of altering the cylinder block angle is provided. The model shown in Figure 1 uses a handwheel. This handwheel can be replaced by any of the control devices mentioned in Part 6 as applied to variable volume, radial piston pumps. When the cylinder block and driving member are in line, pump output is zero; maximum delivery is attained when the block is swung to the limit of its travel.

In the Vickers pump the socket ring is integral with the drive shaft. The steel piston connecting rods are mounted in brass sockets in the socket ring, and the hardened and ground pistons work in bronze cylinder barrels. Figure 1 clearly shows the steel port plate and the path of oil flow from the suction to discharge. These pumps are available in capacities varying from 5 gpm at 1800 rpm to 340 gpm at 900 rpm.

It is of interest to note that the high rotative speeds result in high port velocities making it necessary to supercharge the pump intake to obtain full rated capacity. Using conventional atmospheric intake, approximately two-thirds of the rated delivery is obtainable.

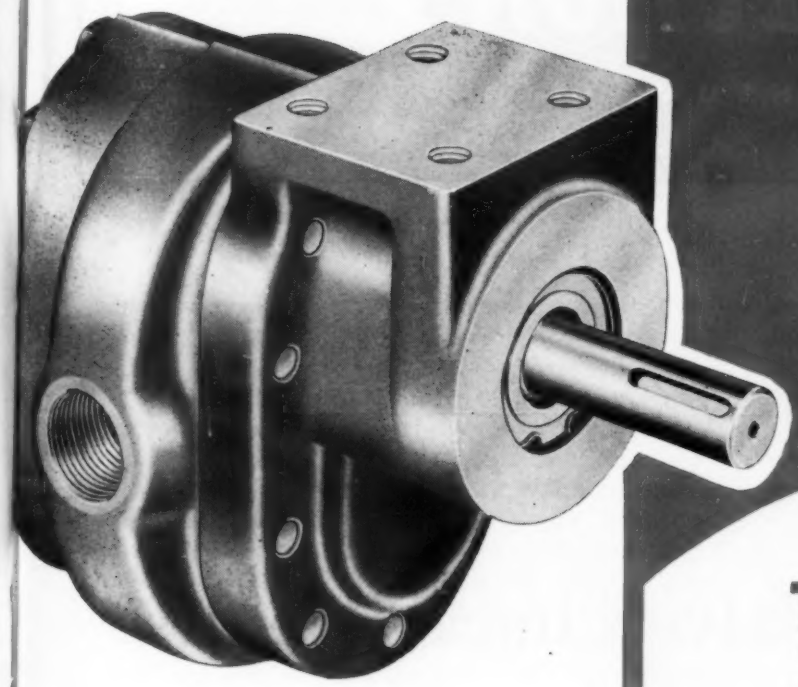
Changing Cam Plate Angle Alters Piston Stroke

The Denison design uses an entirely different method to axially reciprocate the pistons. Each piston has a shoe assembly which is mounted on a cam plate. This cam plate which is sometimes referred to as a swash or wobbler plate is set at any angle to produce reciprocation of the pistons. This angle is varied by the use of the hand wheel to vary the pump output. The hand wheel control may be replaced with pressure compensator control, stem control or cylinder control. These pumps are designed for 5000 psi service delivering oil at rates up to 35 gpm in the larger sizes.

While the fine fits and greater mechanical complexity of piston pumps make it necessary to insure the use of a clean oil of recommended viscosity, these pumps have proven to be very rugged, giving long trouble-free service.

Next month, Part 8 will describe the reciprocating plunger pump.

Savings Turning Up Every Day



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RALPH E. MIDDLETON
Advisory Editor

Aircraft Boost Valve Characteristics

By J. C. MONROE

AIRCRAFT HYDRAULIC BOOST SYSTEMS CAN BE divided into two groups—those with open center boost valves and those with closed center boost valves. An open center boost valve has flow at all times. A deflection of the valve results in the metering of the by-pass flow to drive the actuator. A closed center valve has essentially no flow when at neutral and operates by metering the main flow into one side and out the other of the actuator. We will deal with the valve characteristics needed in an analysis of a closed center system, but similar characteristics can be obtained for use in an open center analysis.

Figure 1 is a schematic and a block diagram of a typical closed center hydraulic system. The portions analogous to the valve itself are indicated by the two valve blocks in the block diagram. One block is determined by the valve characteristics between the pressure port and the cylinder ports of the valve, while the other represents the characteristics between the cylinder ports and the return port of the valve. If the equations for the boost system are written and linearized, the valve flow, qv, can be approximated by the equation shown in Figure 1.

If the characteristics of the valve are measured and a plot is made of flow vs. pressure drop and valve position, values for Cqp and Cqx can be obtained. Cqp is the slope of the

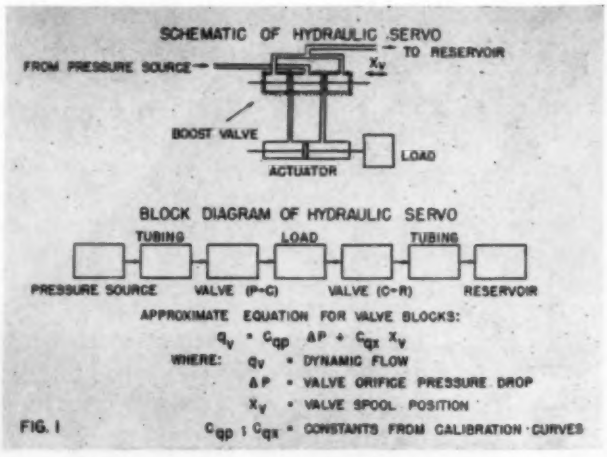

FIG. 1

J. C. Monroe is Servomechanism Engineer with North American Aviation, Inc., Los Angeles, California.

AN AIRCRAFT HYDRAULIC SERVOMECHANISM . . .

controlling any one of the plane's utilities is designed to automatically deliver the proper amount of oil for all load conditions from zero to maximum. Design of a booster valve for the system requires determination of the valve's flow characteristics. Mr. Monroe presents both theoretical and experimental methods for valve calibration, and points out the precautions taken to assure good results.

flow vs. pressure plot at a constant valve displacement. Cqx is the slope of the flow vs. displacement plot at a constant pressure drop.

Of course Cqp and Cqx will have different values for each instantaneous operating condition. To make possible a linear mathematical analysis it is necessary to pick a value for each. This has been done by drawing load lines on the valve characteristic curves and averaging values thus obtained over an operating cycle. The load line is determined by obtaining values for instantaneous operating conditions of the valve and connecting them to form a continuous line on the characteristic curves.

Characteristics Vary With Direction of Spool Travel

Fig. 2 is a plot of flow vs. pressure for the pressure port-cylinder port characteristics of a boost valve. A load line has been drawn on the curves for a particular operating pressure and load. This valve has a large hysteresis in that it has different characteristic curves when a given displacement is approached from opposite directions. This hysteresis causes the load line to encompass an area rather than to form a single line as is typical of resistive load lines used with vacuum tubes.

Valve characteristics can be determined either statically or dynamically. Some valve designs will have essentially the same static and dynamic characteristics. Others will differ greatly. Since the valves are always used dynamically, a correct analysis requires the use of dynamic characteristics. In those cases where the static and dynamic characteristics are essentially the same the static calibration can be used.

Static calibrations are easily made with rotameters for flow measurement, pressure gages for measurement of valve pressure drop, and dial indicators for valve displacement measurements. A pressure drop across the valve is adjusted at a measured displacement. The flow is then measured after it has stabilized.

The dynamic calibration of a boost valve requires equipment to vary the valve position and to measure the three variables (position, pressure drop, and flow) as a function of time.

The most satisfactory method for driving the valve spool is a mechanical sine wave generator. The spool position can be measured with a strain gage deflection beam. Dynamic pressure pickups are available to measure the pressure drop between ports of the valve. If a calibrated orifice is inserted in series with the flow path of the valve, the pressure drop across the orifice will give the valve flow. This pressure drop must, of course, be measured with dynamic pickups.

Proper arrangement of the equipment makes possible the dynamic measurement of the flow and valve pressure drop with only one dynamic pressure pickup. Fig. 3 is a schematic of

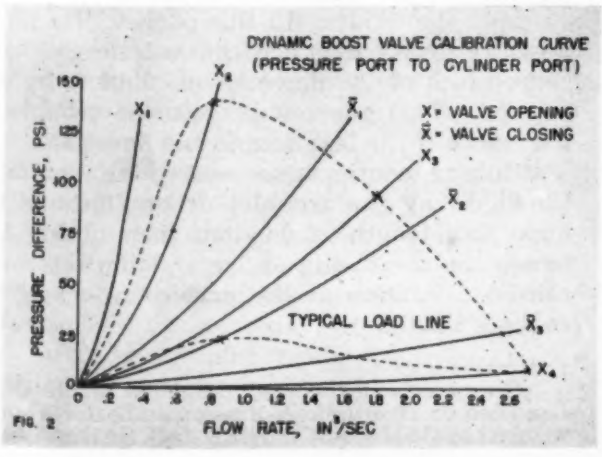

FIG. 2

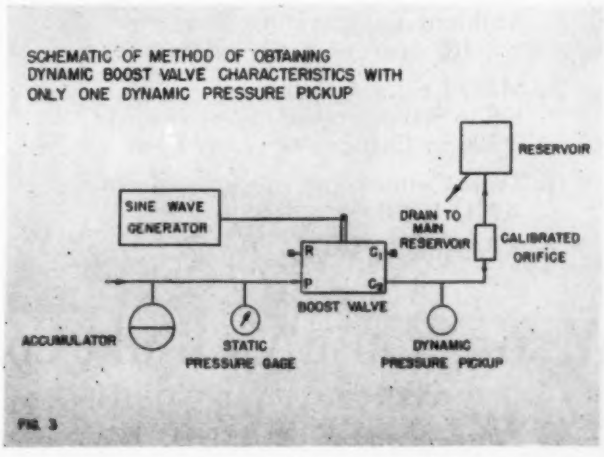

FIG. 3

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it's simple
it's GOOD

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Disc-type construction—delivers either of two inlet pressures from outlet port, depending upon which is the higher. Light, simple, and efficient; provides an excellent means for a dual air supply to an operating device.

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this system. An accumulator is placed at the input of the valve, a calibrated orifice at the outlet of the valve, and the outlet of the calibrated orifice at atmospheric pressure. In this system the accumulator keeps the input pressure to the valve constant, making it possible to measure this pressure with a static gage. The outlet pressure from the calibrated orifice is a constant since it is atmospheric pressure. Therefore, a single measurement of varying pressure between the valve outlet and the orifice input can be used to obtain both pressure drop across the valve and flow through the valve.

Problem of Entrapped Air

The major difficulty in making dynamic valve calibrations comes from phase shift between the various points at which measurements are made. The phase shifts may occur even at frequencies of 1 cps. They may occur in the main flow line or in the associated pressure pickups and their connecting lines. The phase shifts result from system inductance and capacitance. If lines are kept short, inductance will be negligible and the resultant phase shift will be due, almost entirely, to capacitance of the hydraulic fluid and any entrained air.

The effect of air is to greatly increase the compressibility of the fluid. Therefore, extreme care must be taken to remove all air bubbles from the system and to prevent their formation from entrained air in the hydraulic fluid. Pressure pickups must be bled to remove air just prior to making measurements. The bleeding point should be the highest point in the pickup and flow should be large enough to insure the removal of all bubbles. Bleeding the pickups prior to running the test is not a sufficient precaution. All tubing must be arranged so that no elevated pockets are formed in which air may be trapped—this is especially important with pressure pickups.

The orifice forms a special problem. If it is placed in other than a vertical piece of tubing a pocket for air will be formed. The high turbulence at the orifice tends to remove entrained air from the fluid to fill this pocket. If a large pressure drop exists across the orifice, it will cause much of the downstream fluid to be vaporized. This effect will cause no trouble if the orifice is the last item in the flow path.

If tubing lengths are excessive the inertia of the fluid may give trouble. In one instance an eight foot length of one-half inch tubing between the measuring orifice and the reservoir caused cavitation at the orifice and gave erroneous results.

Prepared from a paper presented before Committee on Hydraulic & Pneumatic Systems sponsored by ASME, ASCE, AIEE, IAS, SAE and ARS.

Aircraft Agency Coordinates Materials and Components

The Aircraft Production Resources Agency, chartered by the Munitions Board and set up at the Wright-Patterson AFB, Dayton, is the joint agency for the Air Force and the Navy Bureau of Aeronautics. Its essential job is to straighten out materials problems for the aircraft industry.

Three Service members and one civilian representative head APRA. Col. George Schaetzel, Air Force, is the director; Capt. Roy Jackson, USN, and Col. Richard R. Danek, USA, are the other Service members and Carl Dowell of the Civil Aeronautics Administration will represent the airline and other civil uses of airplanes in the group.

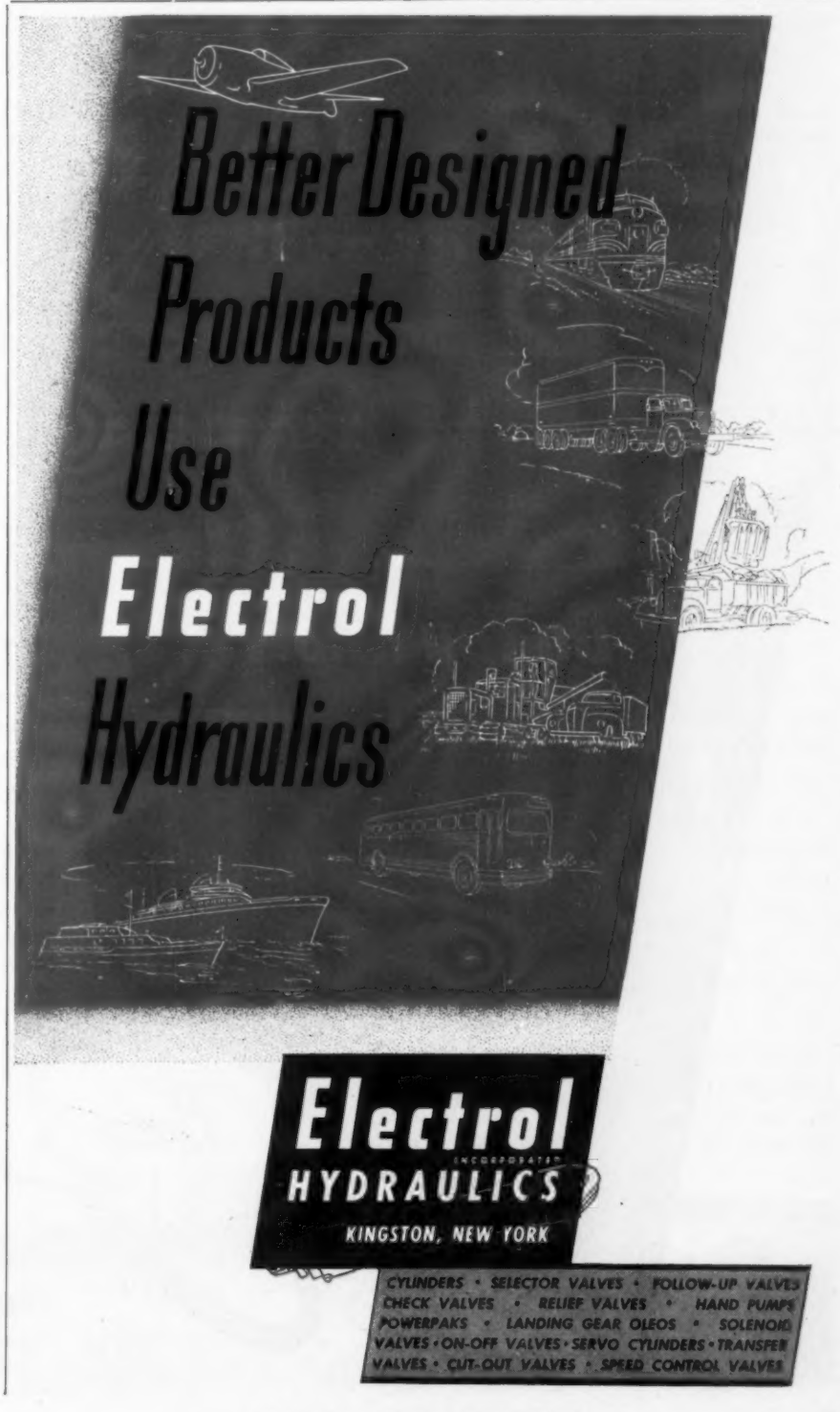
APRA has four sections: Requirements; Materials; Components and Equipment; and Industrial Resources Coordination. Lt. Col. E. F. Brown is chief of the Components and Equipment Section.

With the initiation of the Controlled Materials Plan on April 15, APRA has begun to coordinate requirements on materials. The CMP plan places emphasis on steel, aluminum and copper; the aviation requirements of these and of special metals are being consolidated, resources reallocated to contractors, production schedules for critical materials and components are being prepared and expediting is being vigorously pushed to avoid or solve critical shortages.

While much attention is concentrated on materials, equipment, components and accessory units are also being subjected to the same requirements — allocation-expediting procedure. Hydraulic and pneumatic components, electrical and electronic devices and supplies, instruments, optical and photographic equipment, repair and replacement parts are all included.

The initial small staff of APRA already has completed several projects of the most critical nature. Its work will be felt within a few months. It is estimated that base materials will begin to move to the allocated component or part manufacturer in from three to five months (from April 15).

The program is closely coordinated with NPA's July 1 deadline for specific allotments to producers. With time allowed for prime contractors to pass on or divide allotments to subcontractors, plus processing or manufacturing time, a target date of approximately October 1 is expected for the initial allotted materials to begin to be delivered as finished machines, components, units or parts.



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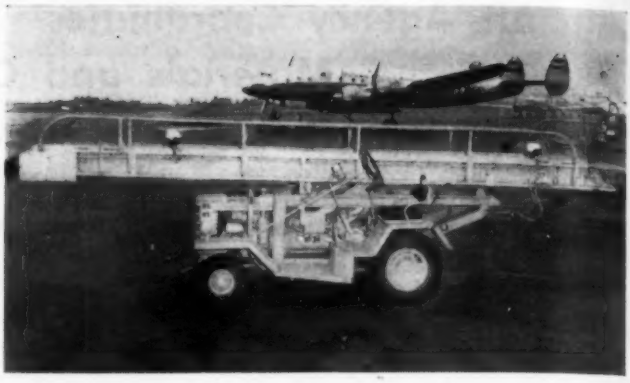
Conveyor Cuts Handling Time



Trans World Airlines is operating a fleet of 25 hydraulically actuated cargo conveyors at its terminals to facilitate the loading and unloading of cargo and baggage. The conveyor is used with the DC-3, DC-4 and Martin aircraft operated by TWA.

The conveyor boom is mounted on two pair of pivoted arms; a three inch double acting cylinder extends to elevate and retracts to lower the boom. A second two inch single acting, spring return, cylinder positions the boom in a fore and aft direction. By a combination of these two movements, controlled by the tractor driver from his seat, the conveyor may be positioned accurately against a plane cargo door very quickly. Both cylinders are controlled by open center valves.

The belt of the conveyor is driven by a gear type hydraulic motor through a gear box to give a belt speed of approximately 75 fpm. Since the belt may be driven in either direction, both loading and unloading is accomplished as fast as crews can handle individual pieces of cargo. Dual controls near either end of the conveyor side frame, permits crew members at either the cargo door or on the runway to change belt direction. This feature also helps speed cargo handling time.

"The advantages of the conveyor may be summarized:

(1) Reduction in baggage loading and unloading time and in damage to baggage;
(2) Reduction in cargo handling time;
(3) Reduction in time lost due to employee injuries sustained while handling heavy cargo packages;
(4) Reduction in personnel required to load and unload baggage and cargo."

—R. K. HORTON, *Engineering Department*, TWA

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Advisory Committee Report

The Technical Advisory Committee on Hydraulic System Materials, Fred O. Hosterman chairman held their last meeting at Dayton in April.

Five major items were discussed: the status of non-flammable fluids; high temperature-high pressure systems; high temperature packings, identification of backup rings; pneumatic system lubricants.

New Non-Flammable Fluid: Leo Chattler, BuAer, reviewed the experience of naval aircraft with H2 a newly adopted water base hydraulic fluid. This fluid, which conforms to MIL-F-7083, has had 20 months of flight testing to date. Chattler reported the H2 performance better in every respect to U-4, the current water base fluid used by the Navy. H2 gave less corrosion and resulted in better pump performance and packing life.

High Temperature - High Pressure Hydraulic Systems: The work being done at AMC on both high temperature and high pressure hydraulic systems was reported by Lt. Christianson, who reviewed the test results on silicone base fluids.

High Temperature Packings: Both of the Services reported on the progress in testing high temperature packings, Bartholomew reporting for AMC and Davidson for BuAer.

Identification of Backup Rings: A considerable amount of discussion developed on the identification of backup rings. Jack Prete of AMC reported that a color code was in process and that a QPL would be ready in about 30 days. Jack Smith of E. F. Houghton & Co. raised the question of identification of the tanner, when different than the ring supplier and suggested a second color marking for the tanner.

Pneumatic System Lubricant: A new pneumatic system lubricant was reported by Jack Prete of AMC as nearly ready.

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Compressor—3000 PSI 2 CFM Integral 220 Volt 3 phase A.C. Motor
Compressor—3000 PSI 2-3 CFM
Hydraulic Pressure
Compressor—1500 PSI .4 CFM
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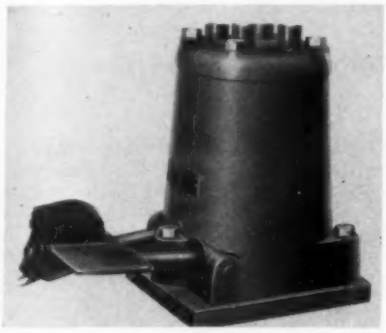

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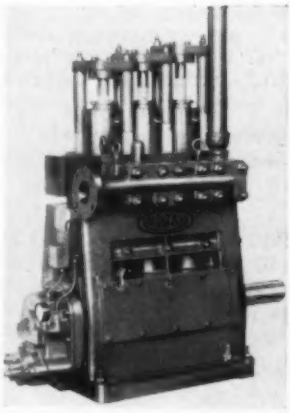
TRIPLEX PUMP—The Aldrich Pump Company announces the addition of a 3 in stroke triplex, Direct Flow Pump to their over-all line. This triplex unit can operate at speeds up to 500 rpm—an increase over previous models, resulting in more work from a lighter, more compact pump. Power ranges up to 50 hp; pressures up to 3800 psi, and displacement up to 96 gpm at 790 psi, 500 rpm. The Direct Flow Pump was so named because it passes liquid in a straight line, directly through the working barrel. Aldrich engineers eliminated two right angle turns in the fluid-end block. This change in design resulted in a reduction of "loss space" in the fluid-end. It improved the volumetric efficiency and saved materials as well.



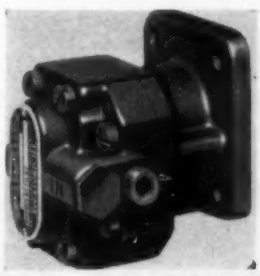
Circle 102 on Reader Service Card

CYLINDER-FINISH TUBING—A new line of tubing especially suited for use as hydraulic cylinders, has been announced by Tube Reducing Corporation. Available in bores ranging from about 1 ½ to 6 in depending on wall thickness, the new tubing is free of scratches, pits and other irregularities which are ironed out when the tube is sized by pressure exerted between two dies and a mandrel. Surfaces of the new cylinder-finish tubing are so smooth that they need no machining for use with leather or other soft packing. For use with metal piston rings, the tubing requires no boring but only a light honing operation.

Circle 103 on Reader Service Card

SURGE DAMPING VALVE—The Denison Engineering Company has designed a new compact valve to prevent hydraulic shock from occurring in a system. It prevents shock rather than absorbing an already formed surge. This valve is adaptable to any hydraulic circuit and both aviation and industrial models are available in a range of sizes for wide application. Easily installed as any ordinary fitting, the valve does not interfere with other functions of the circuit. The valve is normally closed and gradually opens when pressure is applied to the inlet side. When the flow is interrupted, the valve quickly resets and is ready for the next operation. It requires no manual adjustments and has no external drain. The spool inside is normally held closed by a spring to prevent flow from inlet to outlet. It moves to fully open position at a rate controlled by a small, built-in valve that is responsive to the difference between outlet and inlet pressures. This produces different opening speeds at various pressures.

Circle 104 on Reader Service Card



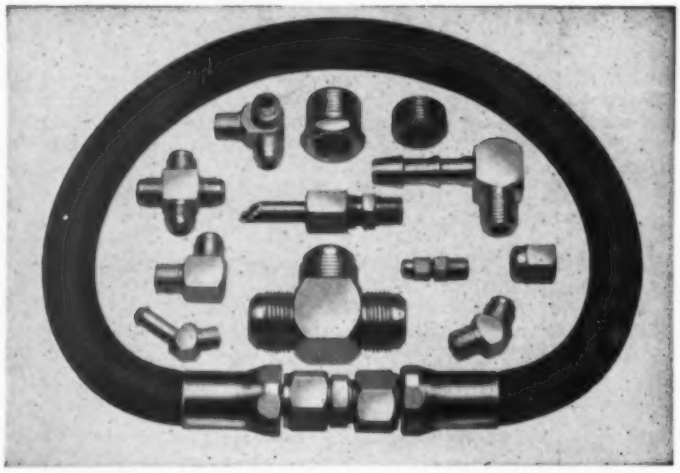
CONSTANT - FLO ROTARY GEAR PUMP—This Gear pump built by John S. Barnes Corp., is now available in high pressure models. Standard types are specified for continuous operation to 1000 psi; and special types are being produced for service to 3000 psi. The new high pressure models feature the use of anti-friction bearings on both gear shafts. Models are available in capacities from .6 to 6 gpm.

Circle 105 on Reader Service Card

WHEN YOU CHANGE TO

J. I. C. Standards

LET L & L SERVE YOUR HYDRAULIC PIPING NEEDS



- **STEEL TUBE COUPLINGS**

  for ⅛th to 2 inch O.D. tubing

  2 PIECE TITE-SEAL FOR ECONOMY

  3 PIECE LOCK-JOINT-SLEEVE TYPE

- **HOSE ASSEMBLIES**

  with pressed-on coupling for single and double wire braid hose

- **PIPE FITTINGS**

  Straight, Ells and Tees with "Dry-seal" pipe threads (N.P.T.F.)

- **PRE-FABRICATING TUBES**

  Let us estimate your preformed tube assembly needs.

Write for catalog and technical data. We also have technical and sales representatives in your area for your convenience.

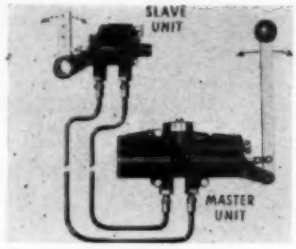
Hydraulic Accessories

L & L Manufacturing Co.

8088 EAST NINE MILE RD. VAN DYKE, MICH.

Circle 40 on Reader Service Card

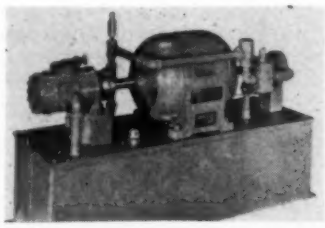
REMOTE CONTROL SYSTEM—Superdraulic Corporation offers a hydraulic remote control system capable of handling 500 inch-pounds of torque. The complete system consists of a master unit and a slave unit interconnected by two small tubes. Motion applied to the actuating lever of the master unit is accurately duplicated by the slave unit lever. It has positive load carrying ability in both directions because its operation is not dependent upon springs, compressed air or valves. This control provides for expansion and contraction of both fluid and metal due to temperature changes in a manner that guarantees synchronization between master and slave units.



Circle 106 on Reader Service Card

SOLENOID—Although of medium size, this new solenoid made by Practical Electric Co., has power sufficient for large size applications. The solenoid is available in three voltage ranges—110, 220, and 440—with ⅝ in maximum stroke, and rated pull or push ranging from 4 to 10 pounds against gravity. It is dimensionally interchangeable with standard solenoids.

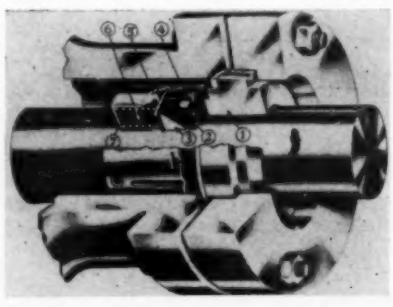
Circle 107 on Reader Service Card



HYDRAULIC POWER PACKAGE — Five sizes in the SRD model, ranging from 7 ½ hp to 25 hp, to cover a wide range of operating requirements are offered by The Cardwell Machine Company. Deliveries range from 12 gpm to 50 gpm, with maximum operating pressure of 2000 psi. These units are mounted on extra-large, welded steel tanks which are completely sealed except for the air breather, to prevent contamination of the hydraulic fluid. Pumps and motor are directly connected with no dangerously exposed moving parts.

Circle 108 on Reader Service Card

MECHANICAL SEAL WITH TEFLON SEALING MEMBER—The Crane Packing Company's new seal, designated as the Type 9 Mechanical Shaft Seal, performs effectively under severe temperature and corrosive conditions. Rather than the leather or synthetic rubber member used in most flexible mechanical seals, this seal incorporates a flexible ring molded from Teflon. The Teflon "wedge-ring" enables this seal to combine the chemically-inert properties of Teflon with the flexibility and positive sealing components essential to effective mechanical sealing.



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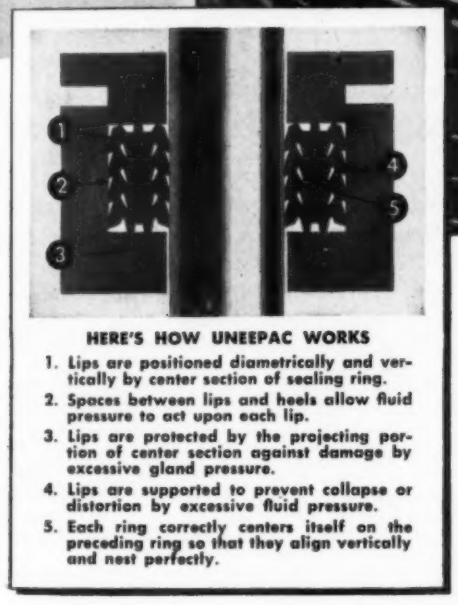


HERE'S HOW UNEEPAC WORKS

1. Lips are positioned diametrically and vertically by center section of sealing ring.
2. Spaces between lips and heels allow fluid pressure to act upon each lip.
3. Lips are protected by the projecting portion of center section against damage by excessive gland pressure.
4. Lips are supported to prevent collapse or distortion by excessive fluid pressure.
5. Each ring correctly centers itself on the preceding ring so that they align vertically and nest perfectly.

Uneepac

...the new Johns-Manville automatic ring packing

YOU CAN SAVE ASSEMBLY TIME by using Uneepac because its unique design practically eliminates packing installation troubles.

Each Uneepac ring is made so that it automatically centers itself on the preceding ring when inserted in the stuffing box. Thus, the entire packing set is aligned vertically and nested perfectly.

Uneepac rings nest so that each lip is always exposed to fluid pressure and responds instantly to its changes. As a result, the assembled Uneepac set seals tightly with minimum friction, reducing wear on both rod and packing.

Because each Uneepac ring is a complete self-protected packing unit, no header or follower rings are generally required—often an additional saving in installation time.

Uneepac is used on hydraulic presses, pump rods and plungers, compressors and similar equipment. This automatic ring packing is available for shaft diameters from ⅝" up.

For more complete information, ask for Brochure PK-58A. Address Johns-Manville, Box 290, New York 16, N. Y. In Canada, write 199 Bay Street, Toronto, Ontario.

JOHNS-MANVILLE JM PRODUCTS

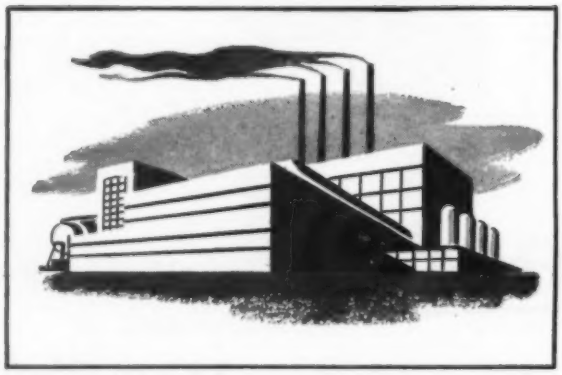
Johns-Manville PACKINGS & GASKETS

Bendix-Skinner

ORIGINATOR OF **MICRONIC** FILTRATION

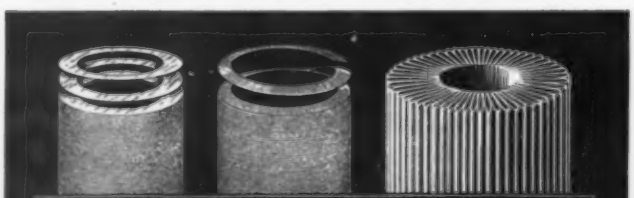
the *Finest*

Way to Make Liquids Come Clean



Nine times out of ten ***Bendix-Skinner*** filters will supply the "finest" answer to your problem. No magic—just the simple fact that ***Bendix-Skinner*** has developed entirely new and exclusive filtering techniques in twenty years of tackling the tough jobs. We'll welcome an opportunity to prove it. An inquiry costs you nothing and may save you much.

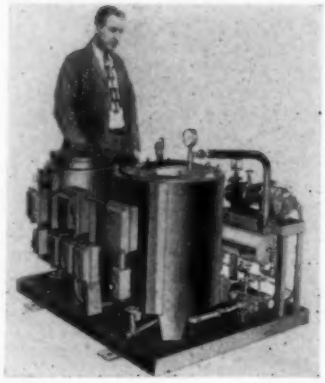
***Over 350 Models** providing filtration from 1/2 micron (.000019") upwards at flow rates from 1 to 5000 g.p.m.*



Disc-type *Ribbon-type* *Pleated-type*

SKINNER PURIFIERS DIVISION OF
1500 TROMBLY AVENUE,
DETROIT 11, MICHIGAN
Bendix AVIATION CORPORATION
Export Sales: Bendix International Division, 72 Fifth Ave., N. Y. 11, N. Y.

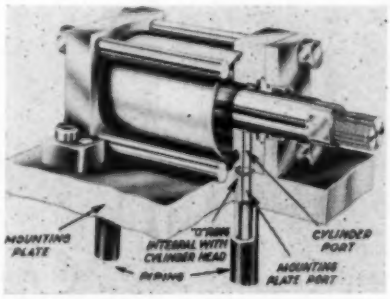
Circle 42 on Reader Service Card



OIL CONDITIONER — Specifically designed for small batch clarification of used hydraulic fluids, a new 25-40 gph oil conditioner has been placed in production by the Filtration Division of the U. S. Hoffman Machinery Corp. Both insoluble and soluble impurities are removed by the unit which combines a cartridge filter and a vaporizer. The cartridge filter and vaporizer are mounted on a common base, portable if desired, and are complete with all necessary electric and pump connections. Filter and vaporizer may be operated singly or together.

Circle 110 on Reader Service Card

CYLINDER MOUNTING—Quick, easy installation of air and hydraulic cylinders singly or in space-saving, side-by-side, manifold mounting without the time, labor and cost of making the actual pipe connections to the cylinders is an important advantage of the new "O" ring cylinder mounting offered in addition to its 13 standard mountings by Miller Motor Company. The piping is directly connected to ports in a machined flat surfaced mounting plate and the cylinders are mounted on this plate with their ports mating in perfect alignment with the mounting plate ports. "O" ring seals at the mating surfaces of the cylinder ports assure a leak-proof seal under pressure and suction and conform to the J.I.C. Standards.



Circle 111 on Reader Service Card

MAGNETIC STARTER—The series YE starters, built by Furnas Electric Company, have a maximum capacity of 10 hp for start-stop control of polyphase and single phase squirrel-cage motors, and for primary control of wound-rotor motors equipped with secondary controls. The starters are provided with thermal overload protection. Rated at 220-550v a.c., starters are available with or without built-in push-buttons or selector switch. Selector switches are used to change control of starter from manual to automatic or vice versa.

Circle 112 on Reader Service Card

Circle 43 on Reader Service Card

Skinner Solenoid Valves

M-2 Bronze Body Diaphragm Valves **M-3**

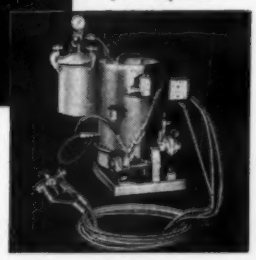
for air conditioning, packaging, refrigeration, air, printing equipment, etc.

The "M" Series valves are approx. 4⅝" high, yet have extremely fast action and large capacity for liquids, air and inert gases! They have soft insert seats to prevent leakage — will operate in any position — nylon fabric coated diaphragm for long life — max. power consumption 10 watts — continuous duty! M-2 two-way normally closed — 5 to 150 p.s.i. — port size ⅜" or ½"; orifice ⅜" — pilot operated. M-3 three-way normally closed, three-way normally open or directional flow — 20 to 150 p.s.i. — port size ⅜" or ½"; orifice ⅜" — pilot operated. Special models available.

Write for Bulletin No. 493

Skinner ELECTRIC VALVE DIV.
THE SKINNER CHUCK COMPANY
142 Belden Ave., Norwalk, Conn.

SEE HOW GAST explosion-proof rotary AIR MOTORS helped solve this problem!



PROBLEM: Specify a motor to drive liquid pump at variable speeds, for Bede Circulating Paint Heater. (A unit for faster, uniform hot finish application.)

SOLUTION: A Gast Rotary Air Motor, running below 500 r.p.m., drives pump at 150 r.p.m. Uses less than 30 p.s.i. air pressure.

RESULT: Power that's economical, dependable, safe. With explosion-proof Gast Motors, entire unit was approved by Underwriters' Laboratories.

Your problem may be entirely different — yet the *unique advantages* of Gast Rotaries may offer just what your product requires. In sizes from 1/20 to 3 h.p., Gast Air Motors are amazingly compact and light in weight. And overloads can't burn them out!

Write Gast, describing your original equipment application. We'll send full details. "Air may be your Answer!"

Original Equipment Manufacturers for Over 25 Years

See our CATALOG in SWEET'S FILE

Gast Application Ideas Booklet — showing 26 design problems solved — sent upon request.

GAST ROTARY AIR MOTORS · COMPRESSORS · VACUUM PUMPS
(TO THREE H.P.) (TO 30 LBS.) (TO 28 INCHES)
GAST MANUFACTURING CORP., 131 Hinkley St., Benton Harbor, Mich.

Circle 44 on Reader Service Card

Circle 45 on Reader Service Card

Protect HYDRAULIC EQUIPMENT

WITH HIGH PRESSURE

MICRONIC FILTERS

- 3000 p.s.i. Operating Pressure, Micronic Filtration, Low Pressure differential, Compact in Line Type

- Maximum Protection at minimum cost. Replaceable element.

West Coast: H. E. Webb
918 N. Kenilworth Ave., Glendale, Calif.

WATERMAN ENGINEERING Company
1221 CUSTER AVENUE • EVANSTON, ILLINOIS

Stock Fewer Spares . . . You Can Use

Nicholson Valves for Any Pressure Medium

Nicholson control valves offer maximum adaptability. A rubber processor reports that they carry only 1 spare valve for each 52 in service. Unlike many poppet or balanced piston valves, they can be used for steam as well as air, gas, oil or water. Lever, foot, solenoid, motor types; size ¼" to 2½"; press. to 5,000 lbs.

To see their wide applications send for . . .
Catalog 1250

W. H. NICHOLSON & CO.
213 OREGON ST.
WILKES-BARRE, PA.

Sales and Engineering Offices in 53 Principal Cities

Circle 46 on Reader Service Card

IT'S A FACT!

DOLLARS TO DONUTS

YOU'LL BE DOLLARS AHEAD

WITH PERFORMANCE-PROVED

GRC O'RING SEALS IN

YOUR PRODUCT !!

IF YOU NEED PRACTICAL ASSISTANCE

GRC TECHNICAL ENGINEERING

SERVICE IS AT YOUR DISPOSAL

FOR VALUABLE INSTALLATION DATA

ON AN6227 - AN6230 - AN6290 -

SERIES SEALS, WRITE FOR

YOUR FREE GRC CATALOG "C"

AND BULLETIN P-112

Goshen Rubber Co., INC.

MOLDED RUBBER SPECIALTIES, WASHERS

QUALITY MECHANICAL RUBBER GOODS FOR 35 YEARS

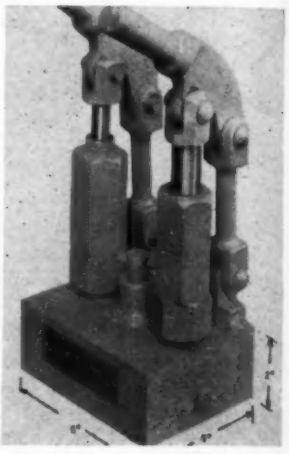
1523 SOUTH TENTH STREET • GOSHEN, INDIANA

Circle 47 on Reader Service Card

PUSH-BUTTON PENDANT CONTROL STATION—The Bulletin 800T pendant push-button station is a new oiltight control station presented by Allen-Bradley Company. It is designed for use as a portable control or for suspension above a machine where it may be easily reached while the operator is near his work. Pendant push-button stations may be obtained in sizes having three units including the stop, to 10 units including the stop. Standard stop unit is a wobble stick in the bottom of the enclosure, but can also be furnished as a mushroom head mounted in the bottom or in the front of the enclosure.

Circle 113 on Reader Service Card

HAND PUMP—Wm. S. Pine has recently put on the market a hand pump for generating oil pressures to 20,000 psi. Three standard reservoir sizes are offered: 70, 360 and 600 cu. in.; and three piston sizes: ⅜, ½ and ¾ in. The double pump is pictured here; a single piston pump is also offered. Built to operate at temperatures down to minus 65F, the pump will supply pressure oil for many testing, maintenance and material handling applications.



Circle 114 on Reader Service Card

SMALL AIR CYLINDER—A 1 1/8 in bore, 1 in stroke, single-acting, spring return air cylinder has been added to the line of "Controlled-Air-Power" devices manufactured by The Bellows Company. The new unit was developed primarily for use in jig and fixture operations and for parts positioning and ejection. Trade-named the HAN-D-AIR CYLINDER, it develops a thrust approximately equal to the applied air pressure. Compact in design, the cylinder can be mounted in practically any position.

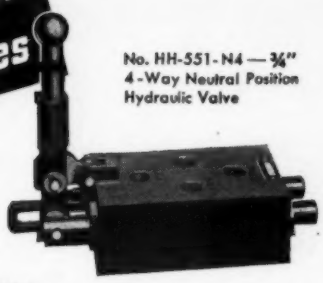
Circle 115 on Reader Service Card

PISTON RING SEAL — For the first time, the sealing member of a one-piece piston ring is located on the inner side of the ring. Available from the Double Seal Ring Company, the inner sealing member extends the full width of the ring giving a ring which seals fully from both sides and cannot be installed upside down. These features make it ideal for use on single-groove, double-acting pistons.

Circle 116 on Reader Service Card

Circle 71 on Reader Service Card

Quick-As-Wink AIR AND HYDRAULIC Control Valves



No. HH-551-N4 — ¾" 4-Way Neutral Position Hydraulic Valve

LEVER OPERATED Hydraulic Valve

For water or oil hydraulic systems to 5000 p. s. i.

● Unsurpassed for efficient trouble-free service controlling double acting hydraulic cylinders and other important high pressure hydraulic circuits. Positive, fast acting. All parts are in pressure balance, eliminating any tendency to creep or crawl. Machined steel housing, chrome plated and polished stainless steel plungers. Self sealing U-packers. Metal valving rings take the impingement of the liquid, preventing wear on the packings. ½" to 1½" sizes. Available also in pilot operated designs up to 4". *Write for full details.*

THE HIGHER THE PRESSURE THE TIGHTER THE SEAL

Quick-As-Wink AIR AND HYDRAULIC Control Valves

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

Mfd. by **C. B. HUNT & SON, INC., 1962 E. Pershing St., Salem, Ohio**

Circle 50 on Reader Service Card

PEMACO HYDRAULIC AND AIR CYLINDERS with the NEW Cartridge Type Packing Gland

Designed to J. I. C. Hydraulic Standards

Pemaco Hydraulic Cylinders are soundly engineered—give long life and top performance. The steel ram is hardened to 50.C Rockwell, ground and lapped. NOW the Pemaco has the first self-contained Cartridge Type Packing Gland.

This new Pemaco "EASY-PAK" Gland is designed to comply with J.I.C. Standards. It combines double bearing surface, low friction ram seal, and a ram wiper into a single compact unit. Easily maintained, the Pemaco "EASY-PAK" Cartridge Type Packing Gland can quickly be replaced in most cases without removing the cylinder from the machine — and by inexperienced help — greatly reducing machine down-time.

Pemaco "EASY-PAK" Cartridge Type Packing Glands are manufactured for both hydraulic and air cylinders.

PETCH MANUFACTURING COMPANY

Write for complete information and engineering data.

36100 HARPER AVE. MT. CLEMENS, MICH.

AIR-MITE Air Cylinders

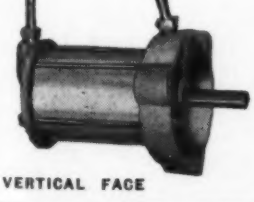
Single Acting

MICRO

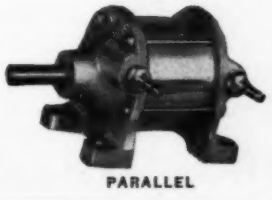
Double Acting

CLEVIS

VERTICAL



VERTICAL FACE



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Worth Their Weight in GOLDen Man-Hours

Save time, spoilage, cost . . . speed production . . . reduce fatigue . . . on all drilling, reaming, tapping and processing jobs. Available in 1", 1½", 2¼", 3", 4" and 5" diameters; stroke length optional. Single or double action; all mountings.

Write for complete catalog of Air Cylinders and Air Arbor Presses.

AIR-MITE 4417-A West Carroll Ave. Chicago 24, Illinois

Circle 49 on Reader Service Card

SAVE UP TO 85% in WAR SURPLUS HYDRAULICS

SPECIAL BARGAIN #29 HYDRAULIC CYLINDER

Gives 20,000 lbs. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lbs. thrust with 3,000 lbs. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1¾" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road farm and shop machinery, presses, etc. Cost Government $390.00 . . . . . NOW **29.95**

HYDRAULIC CYLINDERS

NO. 3A – Bore 1½", Shaft ½" Stroke 5", Length 10½" **5.75**

NO. 9E – Bore 1-3/8", Shaft 1" Stroke 15-5/8", Length 15⅝" **8.50**

NO. 35 – Bore 1½", Shaft 1" Stroke 26", Length 23½" **15.75**

HYDRAULIC TRANSMISSION

Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever.) supplying piston hydraulic motor. Automatic pressure, Dash pot for smooth control. Power output R.P.M. – 0 to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2 - 4" Spline Shafts for input and power take-off. Cost Government approx. $400.00 **32.50**

AN-Hi-PRESS. HOSE (FUEL – OIL & AIR)

1/4" Tube Size – 7/16 x 20 Thread – 16" long with Male and Female fitting at either end. . .95¢ each.

1/4" Tube Size – 7/16 x 20 Thread – 22" long with Female fittings at both ends. . . . . .95¢ each.

3/8" Tube Size – 9/16 x 18 Thread – 20" long with Female fitting at both ends. . . . . $1.90 each. Same as above but 63" long. . . . . $3.75 each

1/2" Tube Size – 3/4 x 16 Thread – 24" long with Female fittings at both ends. . . . . $2.65 each. Same as above but 67" long. . . . . $3.75 each.

5/8" Tube Size – 7/8 x 14 Thread – 15" long with Female fittings at both ends. . . . . $2.25 each. Same as above but 36" long. . . . . $2.95 each.

HYDRAULIC PUMPS

ANGLE PUMP

Positive displacement type, angle piston. Displaces .507 cu.in. per revolution. Has capacity of 6 gal. per minute at 3000 RPM at 1500 PSI continuous 1875 for 15 seconds. Operating speed of 3750 RPM, intermittent maximum 4500 RPM. Rotates to the right only. . . . . NEW **17.50**

P-3 STRATO POWER PUMP With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. Two gal. per minute capacity at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous. 1400 PSI for 15 seconds. Operates at 3750 RPM, intermittent maximum 4500 RPM. Rotation either direction without adjustments. NEW **17.50**

FOUR WAY VALVE

V-2B – Poppet Type. Off at neutral position. 3/8" AC Tube Ports – (9/16 - 20) thread. P.S.I. 1,500 . . . . . **4.75**

V-17 – Poppet Type. Pressure balanced. Offset neutral position. Piston type with built-in relief valves for limit of cylinder strokes. ½" Standard pipe inlet & outlet ports. ½" AC tube to cylinder (¾" - 18) thread tapped ports. NEW **8.75**

GEROTOR TYPE PUMP

Logan Gerotor type. For operating hyd. systems on tractors, trucks industrial machinery, etc. Delivers 8 GPM, at 1200 RPM, at 1000 PSI with 5 HP. Can also be used as Hydraulic Fluid Motor. Has 3/8" stnd. pipe ports, ½" splined shaft for pulley or direct attachment. 5½" dia. x 7" lg. Used but guaranteed condition. Now ONLY **19.50**

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for inform.

PALLEY SUPPLY COMPANY 6321 San Fernando Rd. Dept. A-7 Glendale, 1, Calif.

– WRITE FOR 1951 CATALOG – OVER 200 PAGES OF BARGAINS in machine tools (taps, drills, dies, reamers, etc.). Hydraulic Cylinders, Valves, Pumps & Motors. Air Tools & Bearings.

Circle 51 on Reader Service Card

Useful Catalogs and Bulletins

available for reference

Hydraulics for Mobile Equipment . . . Specifically designed to assist the users, designers and manufacturers of earthmoving, agricultural and material handling equipment in the selection of hydraulic components, this new 16 page catalog released by Vickers Incorporated provides a ready reference. Specifications, charts and design details are given for all hydraulic power packs, pumps, new series multiple unit valves, steering boosters and motors. Typical installation drawings of hydraulic components on mobile equipment are illustrated. Cross-section drawings of pumps and valves clearly show the construction of this equipment.

Circle 121 on Reader Service Card

Manufacturing Hydraulic Equipment . . . R. D. Wood Company, manufacturers of hydraulic equipment have issued a photographic booklet covering certain of the company's production divisions. Reproduced by sheet-fed gravure in two colors, the 32-page booklet is designed to give an informative picture of some of the 150 year old firm's facilities, methods, and equipment, particularly as they relate to the manufacture of hydraulic equipment. This attractively illustrated booklet gives a clean-cut view of American industry at work.

Circle 122 on Reader Service Card

Noise Control in Pneumatic Systems . . . Design, safety and performance features radial-flow air exhaust mufflers are emphasized in an 8 page descriptive bulletin issued by Allied Witan Company. Graphic test data includes a chart showing air pressure vs noise level. A second graph which gives the discharge factor vs air pressure for the muffler indicates the very small flow slow-down through the muffler. A sectional view shows the noise dispersement pattern, as exhaust air flows through the muffler. Sizes and applications are given.

Circle 123 on Reader Service Card

General Purpose Relays . . . Bulletin 370 available from R-B-M Division of Essex Wire Corp. describes their line of magnetic relays. Mounting data, contact construction, contact arrangement and contact rating of single pole and double pole d.c. and a.c. relays are charted.

Circle 124 on Reader Service Card

Automatic Ring Packing . . . Johns-Manville's new Uneepac ring packing is described in an available 4 page catalog. Construction, application and installation are shown. This new packing shape gives a compact seal built from separate, individual complete, self-contained packing rings locked on top of each other. This molded shape gives a locking arrangement which results in a minimum packing depth. The spaces between lips and heels allow fluid pressure to act upon each lip; lips are supported to prevent collapse or distortion by excessive fluid pressure and each ring correctly centers itself on the preceding ring so that they align vertically and nest perfectly.

Circle 125 on Reader Service Card

Aviation Hydraulics . . . A new helpful catalog designated as **Bulletin 300**, and covering aviation products is being offered by Eastern Industries, Incorporated. Bulletin 300 gives important engineering data on aviation pumps, pressurization units and heat transfer equipment manufactured by Eastern. Using large type, simple diagrams and concise tables makes this bulletin ideal for quick reference.

Circle 126 on Reader Service Card

Vibration Control . . . Here is a well prepared, easily understood bulletin offering solution to the problems of shock and vibration. Presented by the Barry Corp, Catalog 504 A discusses shock and vibration isolation by the proper selection of a suitable mounting. Fifteen distinct types of mountings are described.

Circle 127 on Reader Service Card

Non-Inflammable Hydraulic Fluid . . . Developed for use in aircraft hydraulic systems, H2 is fully described in a 16 page booklet issued by R. M. Hollingshead Corporation. The booklet tells of the history and development of the new fluid and sets forth its properties and composition. The characteristic of non-inflammability of H2 is established by its water base, and the inclusion of a basic ingredient provides complete protection against freezing to temperatures below —60F under conditions of motion. Servicing procedures are discussed. Separate, large bound-in charts plot thermal properties, specific gravity, viscosity and specific heat of this new fluid under varying operating conditions.

Circle 128 on Reader Service Card

Air and Oil Cylinders for Large Force Applications . . . Columbiana Engineering Company offers Catalog 3451 which includes drawings and specification sheets on their heavy-duty air and oil cylinders. Designed originally for applications in steel mills, these large bore power units are suitable for applications requiring large force multiplication. Cross-sectioned drawings show the rugged construction features in both bolted flange and tie-rod designs.

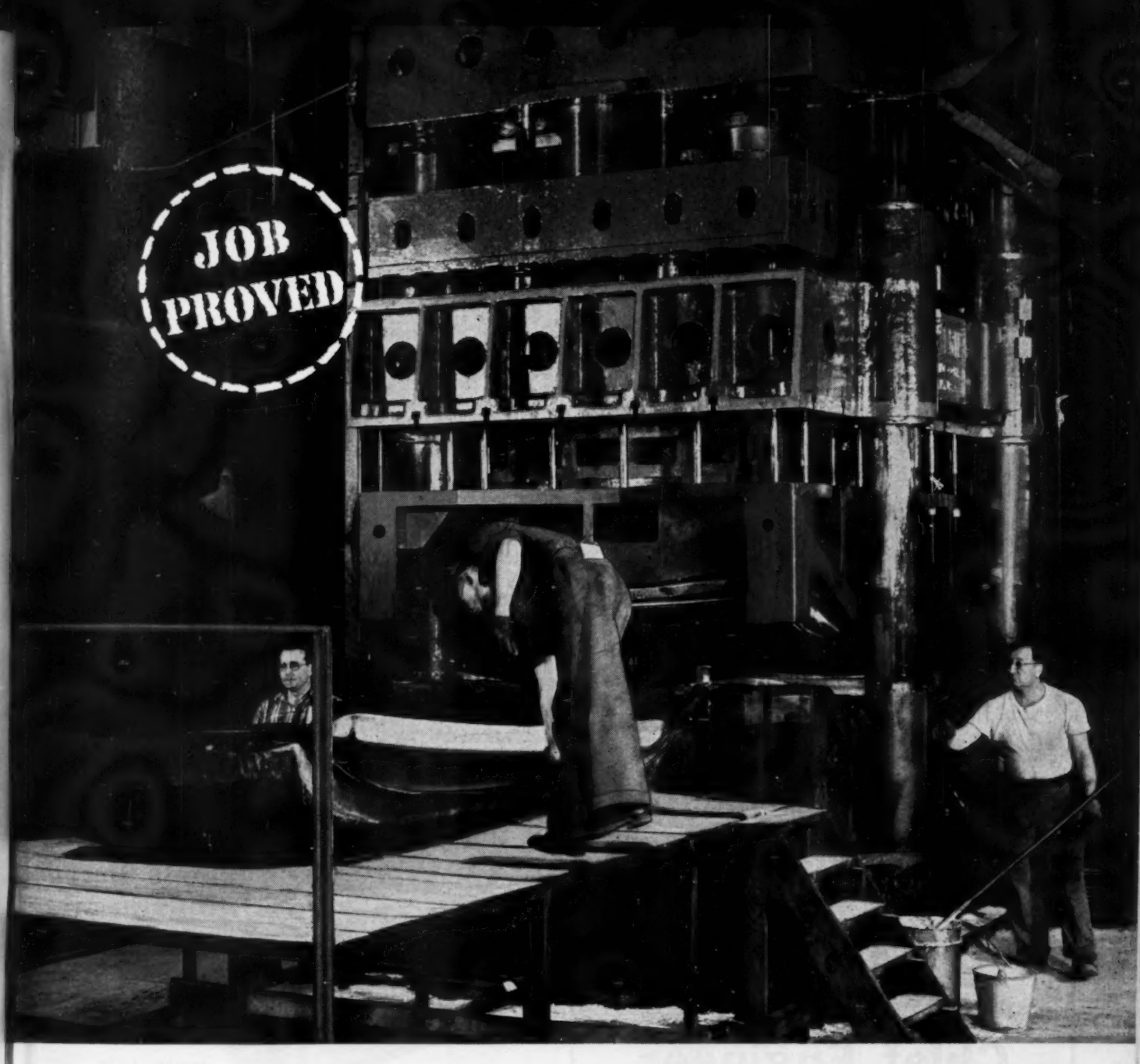
Circle 129 on Reader Service Card

Aviation Components . . . Bendix Aviation Corporation has issued an illustrated 40 page brochure which lists the hundreds of different products supplied by the Corporation's 15 plants. The booklet contains detailed descriptions of products and of the manufacturing facilities. Of particular interest to the hydraulic component user is the section describing the actuating devices and controls made by the Pacific Division.

Circle 130 on Reader Service Card

Water Hydraulics . . . E. F. Houghton & Company's April Service Bulletin presents the advantages and disadvantages of using water as a fluid power medium. Problems of freezing, scale formation, low viscosity and lubrication are discussed.

Circle 131 on Reader Service Card



SUNVIS 931 GIVES PERFECT PERFORMANCE

Press Free of Rust and Corrosion; Makeup Not Needed; Original Charge of Oil As Good As New After 3 Years

Three years have elapsed since a light-truck manufacturer installed a 350-ton hydraulic press for stamping and drawing tops. In this length of time the original charge of oil . . . 750 gallons of Sunvis 931 . . . has never been changed. Nor has makeup ever been required. Regular inspections prove the oil to be good as new. Furthermore, the press has never shown a sign of rust or corrosion—even after shutdowns for model changes.

Performance like this explains why "Job Proved" Sunvis 900 Oils are in wide demand wherever circulating systems dictate quality. Every oil in the Sunvis 900 Series eliminates oxidation and sludging, prevents rust and corrosion. Sunvis 900 Oils are the finest lubricants available for hydraulic systems, turbines, and similar applications. For a free, illustrated booklet on Sunvis 900 Oils, write Department AH-7.

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SUN PETROLEUM PRODUCTS

"JOB PROVED" IN EVERY INDUSTRY

SUNOCO®

Circle 53 on Reader Service Card

When the Heat's On and the Pressure is Great—

the new Cycl-Flex by EAGLE furnishes the "Brainwork"!

Three EAGLE Flush-Mounted CYCL-FLEX TIMERS with "Oil-Proof Dial" control the sequence of operations on the new 300-ounce Plastic Injection Molding Press built by the Watson-Stillman Company.

there's an Eagle Timer to control your Industrial Processes!

Write for Eagle Bulletin 120!

EAGLE SIGNAL CORPORATION Moline, Illinois

WANTED

Chief Engineer

Outstanding opportunity as Chief Engineer of Industrial Hydraulics Division with leading manufacturer of hydraulic equipment located in the Middle West.

Require graduate mechanical engineer with minimum of ten years design experience plus administrative experience and ability.

Position requires a background of hydraulics in the higher pressure ranges and creative design ability.

Applicant must have the personal qualifications necessary to organize and carry out a product development program from assignment to successful commercial application.

Please write, outlining education and experience and stating age, references and salary desired.

Address: "Applied Hydraulics": Box No. 7151

Oil or Air Drilling and Tapping Unit . . . Hypneumat Inc. has issued a bulletin describing their "Package Power Plant" with combined rotating and reciprocating spindle mounted on ball bearings within a quill. Reciprocating action is from an integral hydraulic cylinder which is equally efficient with air or oil power. The bulletin illustrates design and construction features of the basic head, the control cabinet and the stroke control assemblies. Having a drilling and tapping capacity of ⅝ in. in steel, with a spindle thrust of more than 700 pounds, the unit can readily step up production on drilling and tapping jobs.

Circle 132 on Reader Service Card

Application of Accumulators . . . Greer Hydraulics, Inc. has released Bulletin 301 describing the construction and operation of their hydro-pneumatic accumulators, and illustrating circuits showing how accumulators are used for an auxiliary source of power, for holding work in closed systems, as a means for operating secondary circuits, as a volume compensator, and as a pulsation dampener. This interesting bulletin will assist you in determining the proper size of accumulator to use in your hydraulic systems.

Circle 133 on Reader Service Card

Compressed Air Filter . . . Selas Corporation of America offers a Bulletin Sheet on their new Liquijector. Having no moving parts, the Liqui-jector is used for continuous, automatic cleaning of large volumes of compressed air and other gases contaminated with water free oil, water-oil emulsions and dirt. Specifications are given for three models which will handle 100, 250 and 500 cfm of free air at 150 psi.

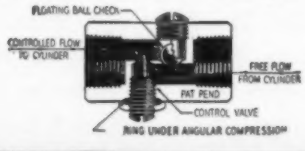
Circle 134 on Reader Service Card

FLOW CONTROL VALVE

for Cylinder Speed Adjustments OVER A WIDE RANGE IN AIR OR HYDRAULIC USE

The Pneu-Trol Flow Control Valve combines an efficient Stainless Steel FLOATING BALL CHECK which opens and closes at the slightest change in flow direction, with a Vernier Type VARIABLE NEEDLE ORIFICE adjustment in a compact control which has widened air and hydraulic cylinder application by providing precise control of cylinder action. Modifications of the Pneu-Trol Valve are available as Plain Check, check with Fixed Orifice (orifice drilled by customer in the Standard Check Valve), Needle Valve and Velocity Limiting Check, as illustrated at left. All Pneu-Trol Valves are made from bar stock in brass (up to 1000 psi) or steel (5000 psi) or other body metals to your specifications. All internal parts are Stainless. All valves available in 5 sizes—⅛", ¼", ⅜", ½", and ¾".

Attractive prices — immediate delivery. Write for illustrated circular and price list.



. . . WRITE

Pneu-Trol Devices, Inc.
1426 N. Keating Ave., Chicago, Ill.

Circle 54 on Reader Service Card

Silicone "O" Rings . . . The Arrowhead Rubber Company is offering design engineers two new manuals which give complete information on "O" rings molded from silicone rubber compounds—the new rubber which possesses remarkable characteristics not found in any other elastomer. One manual gives the latest comprehensive data on silicone rubber—its uses and characteristics, with typical applications; the other manual gives all necessary information on the use and selection of "O" ring seals. Included are such valuable data as proper design of mechanisms and equipment using "O" rings, the importance of designing for proper "O" ring installation, illustrations of good design and precautions to be taken to avoid damage to seals.

Circle 135 on Reader Service Card

6000 PSI Axial Piston Pump . . . Featuring a flat efficiency curve between 1000 and 6000 psi, the Blackhawk P-197, heavy duty wobble-plate 6 piston type pump is described in Bulletin 2-P. Mounting arrangements, characteristic performance curves and cross-sectional drawings give complete application data on this line of pumps, which is designed for power requirements up to 11 ¾ hp.

Circle 136 on Reader Service Card

Cartridge Packings . . . Six specification drawings have been prepared by the Hydraulic Accessories Co. for their Monopak Cartridge. Built in both light and heavy duty models in sizes from ⅝ to 3 ½ in for the rod dimension, these packaged units are finding wide use in hydraulic applications. The specification sheets provide dimensional data for both the packing and the rod and housing for which the cartridge is installed to seal.

Circle 137 on Reader Service Card

Air Valve Catalog . . . A new 44 page, illustrated catalog describing its complete line of valves is now available from Ross Operating Valve Company. Hundreds of standard models and modifications are described, including straightway, three-way, four-way and four-way five port units in various sizes of hand, foot, solenoid, pilot, remote control, cam, speed control, shut-off, quick exhaust and miscellaneous valves. Detailed descriptions are given together with sectional views, installation data and diagrams. Several pages of the catalog are devoted to general reference data, including a non-technical explanation of air valve, operation and the difference between various types.

Circle 138 on Reader Service Card

Vee-Flex Packing Rings . . . New four page bulletin featuring R/M Vee-Flex Packing Rings has been issued by the Packing Division of Raybestos-Manhattan, Inc. Made in five types, these rings are recommended by the manufacturers for use in valves, pumps, hydraulic cylinders, rams, presses and lifts against a long list of services and pressures. The bulletin describes in detail conclusions drawn by Raybestos Manhattan engineers from tests performed recently at the Franklin Institute Laboratories for Research and Development.

Circle 139 on Reader Service Card

Flexible Couplings . . . Bulletin 52 illustrates a type and size of flexible coupling for every direct connected drive. Along with special assemblies, The Climax Metal Products Co. offers three standard couplings having bores from ½ to 5 in and power ratings from 1/3 to 75 hp. The bulletin includes recommendations for the application of these three standard types and a convenient procedure is presented to help you select the right size coupling.

Circle 140 on Reader Service Card

Circle 56 on Reader Service Card

NEW! DIFFERENT!

TWO NEW VALVES FOR *Effortless* CONTROL OF AIR CYLINDERS!

TYPE NH (above)—A new hand-operated, four-way, directional air control valve. Sizes ½" and ¾". ⅝" lever motion.

TYPE NF (right)—A new foot-operated, four way, directional air control valve. Sizes ½" and ¾". With or without pedal guard.

HERE is the newest thing in air valves for operating single or double acting air cylinders! Built for *hand or foot* operation, these instant-acting valves provide fast, effortless control comparable to an electric valve—*at minimum cost.*

DISC TYPE; SELF-LAPPING—Metal-to-metal seat. Air tight. Packless.

PILOT CONTROLLED; PISTON OPERATED—Only light touch required; air does the work—shifts the main valve.

PRECISION ENGINEERED—Simple, compact, self-contained; rugged! Try one today. *Ask for bulletins.*

HANNIFIN *Corporation*

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Keep it running

with CAPITAL OIL FILTERS

EASY TO INSTALL, CLEAN AND MAINTAIN AT TOP EFFICIENCY

Avoid costly breakdowns with the new Capital hydraulic reservoir type oil filter which features a non-corrosive, trap-weave wire cloth, giving clean oil at an extremely low pressure drop. Get full protection — various sizes of filter screens can be interchanged in minutes — can be cleaned without taking apart. Its greater filtering area traps all foreign particles and helps to keep your equipment running at top efficiency.

Capital filters designed to J.I.C. standards are available in filtering capacities of 5, 10, 20, 30 and 50 gals. per minute. Larger capacity sizes can be supplied to meet special requirements. Get bulletin AH-1 for complete details.

CAPITAL

Select territories are available to progressive distributors. Inquiries invited.

ENGINEERING AND MANUFACTURING CO.

5837 South Ashland Ave. • Chicago 36, Ill.

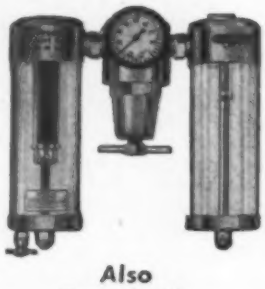
Circle 62 on Reader Service Card

Circle 61 on Reader Service Card

"M-B" AUTOMATIC

Air Line FILTER, REGULATOR and LUBRICATOR ASSEMBLY

"Sentinel of the Air Line"



FILTER element removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR is capable of passing large volume with an unrestricted flow and minimum amount of pressure drop. Self-bleeding, compact, simple. Machined from bar aluminum. LUBRICATOR delivers desired volume of oil. Adjustable Venturi Valve permits efficient operation on broad range of volume and pressure. Bowl can be refilled without shutting off air supply. Any of these 3 devices can be used as separate units or in any combination.

Write for Literature

Also *Pneumatic Grinders*

"Remember, Built-in quality remains long after first-cost disappears"

M-B PRODUCTS

46 Victor Ave.
DETROIT 3, MICHIGAN

Thermo-Regulators and Thermostats . . . Completely illustrated with photographs and cut-away drawings, this 12 page Catalog No. 18 provides a useful aid in obtaining precise and reliable temperature control and regulation. Offered by the H-B Instrument Company these instruments may be selected according to accuracy requirements from plus or minus .0005°F to plus or minus .10°F. This mercury actuated equipment includes a range of temperatures from minus 35°F to 350°F. The catalog is planned to aid engineers and technicians select the most suitable equipment for temperature control work.

Circle 141 on Reader Service Card

Metal Bellows and Bellows Devices . . . Here is an informative booklet prepared by the Bridgeport Thermostat Division of Robertshaw-Fulton Controls Co. Bulletin 100 is presented to supply the elementary and essential data on the Bridgeport bellows and to depict a few of its many applications. A nomograph gives service life expectancy as a function of operating stroke and pressure. Factors which determine the use and service life of bellows are discussed along with manufacturing processes. Available types of bellows are illustrated and physical characteristics are tabulated in handy chart form. Assembly design including shaft seals are sketched. Also included in this 28 page bulletin are useful engineering tables and charts giving vapor pressure and temperature relationships.

Circle 142 on Reader Service Card

Magnetic Controls . . . Starters, contactors, relays and accessories are detailed in Catalog 50 issued by Furnas

Another Giant Industy Uses

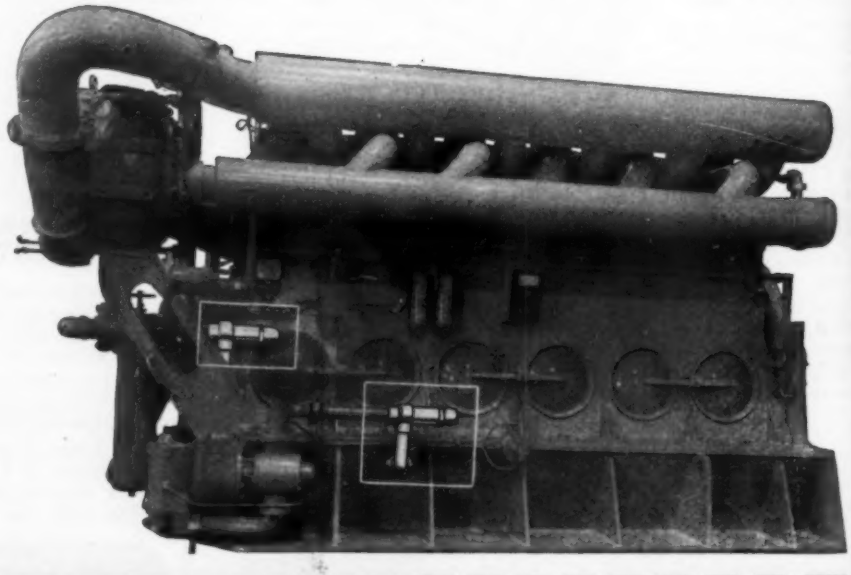
THE BALDWIN LOCOMOTIVE CO. is famous for its insistence on highest quality and efficiency in every detail.

TRADE MARK FULFLO REG. U. S. PAT. OFF.

BY-PASS OIL RELIEF VALVES

America's most successful valves

Two FULFLO OIL-RELIEF VALVES are applied to the lubricating oil piping system of the 1000 hp supercharged Diesel engine in Baldwin Diesel Electric Locomotives.



FOR CONSTANT PRESSURES . . .

NO MAINTENANCE . . .

CHATTERLESS.

¼" to 2" standard pipe thread and STD 300 lb. American flange valves 1" to 2".

TRADE MARK FULFLO REG. U. S. PAT. OFF.

Specialties Co., Inc.

BLANCHESTER, OHIO

WRITE NOW on your letterhead for FULFLO MECHANICAL DATA BOOK

Electric company. The magnetic starter provides start-stop control and thermal overload protection for many electric motor applications on hydraulic machinery. The catalog illustrates completely the compact construction, and charts the specifications.

Circle 143 on Reader Service Card

Pressure Gauges . . . Here is an extremely well prepared booklet, using an easy to read format. Prepared by the Heise Bourdon Tube Company, Inc., pressure gage design is completely discussed. The principle of operation of the Bourdon tube, selection of materials, heat treatment and cross-section dimensioning are described. Drawings clearly show the tube mounting and the movement and linkage. Details of dial calibration and mountings for ranges to 10,000 psi are included along with suggestions for the proper use and installation of these precision gages.

Circle 144 on Reader Service Card

Tubing Steels for High Pressure Service . . . Condensed technical information valuable to engineers associated with problems involving the design, fabrication and use of tubing for high pressure applications is contained in a new six-page bulletin offered by The Babcock & Wilcox Tube Company. Known as Technical Bulletin 12F, it contains such information as analyses, physical and mechanical properties, creep strength, short time elevated temperature tensile strength, and oxidation resistance of 14 of the more popular tubing steels. Included are data on carbon, intermediate chrome molybdenum and stainless steels used in high temperature, high pressure service.

Circle 145 on Reader Service Card

Circle 59 on Reader Service Card

Gre-Sen -- the High Quality Hydraulic Control Valve at the Mass Production Price

WILL SOLVE YOUR VALVE PROBLEMS

Check These Superior Features

- Fully Balanced
- Spring Loaded
- Self Centering
- Easy Control
- Precision Built
- Built-in Relief Valve

GRE-SEN HAS BANK VALVE FEATURES

GRE-SEN Control Valves are designed for use as single units or in multiples in any combination desired. Mass production on this better engineered, popular valve gives you important savings in your valve costs.

Model No. 300 is for operating single acting cylinders. Model No. 400 (shown above) is for operating double acting cylinders. Capacity 16 GPM; pressure up to 1,250 PSI.

Write for full facts about this better built, money saving valve.

GRE-SEN Manufacturing Company

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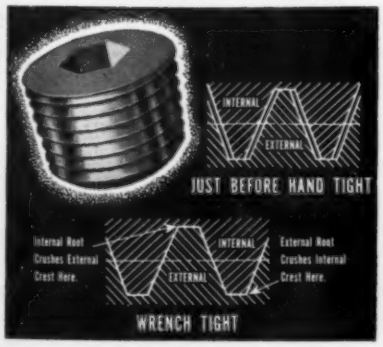
UNBRAKO®

DRYSEAL

THREAD

PRESSURE PLUG



SEALS TIGHT

WITHOUT COMPOUND

Unique thread design of UNBRAKO "DRYSEAL" Pressure Plugs provides positive sealing at both major and minor diameters of threads, preventing spiral leakage, even under extreme pressures. Full range of sizes from 1/16" to 1¼" N.P.T.F.

Write for Bulletin 675.

—SPS—

STANDARD PRESSED STEEL CO.

JENKINTOWN 2, PENNSYLVANIA

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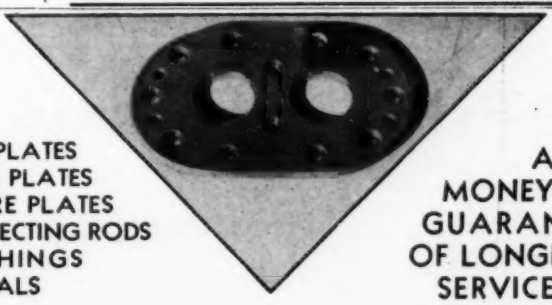
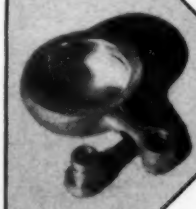
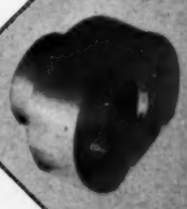


THRUST PLATES
BEARING PLATES
PRESSURE PLATES
CONNECTING RODS
BUSHINGS
SEALS

A MONEY-BACK GUARANTEE OF LONGER SERVICE



PROMET
THE Engineered BRONZE



Machined or rough cast and of the specific formula best suited to the application.

Send blueprints, conditions of operation and other data for recommendations and quotations.

Write for literature today.

THE AMERICAN CRUCIBLE PRODUCTS COMPANY

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NOW READY!

proceedings of the 1950 meeting NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS . . .

Complete text of the 20 papers delivered at the 6th NCIH, covering the entire field of industrial applications. Among papers of special interests are:

- "Operation and Care of Hydraulic Machinery" J. C. Van Gundy
- "Aircraft Hydraulic Equipment Problems" Carl W. Chambers
- " 'O' and 'V' Ring Packings in Industrial Hydraulics" J. H.Swartz
- "Hose Assemblies and Related Fittings" D. F. Stranberg
- "Hydraulic Control Problems in Automatic Transmissions" R. L. Smirl

The NCIH is the major annual meeting in the Hydraulic field. The Proceedings are a necessity for every engineer who wants to keep abreast of the best design, application and operating practices.

For your copy of the 1950 Proceedings (Vol. IV) send $4.50 to F. W. Edwards, Conference Secretary,

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS
Illinois Institute of Technology
TECHNOLOGY CENTER, CHICAGO 16, ILL.

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RHOADS **U-VEE-CUP FLANGE**

Tannate **LEATHER PACKINGS**

"TAILOR-MADE" . . . FOR YOU by Leather Craftsmen

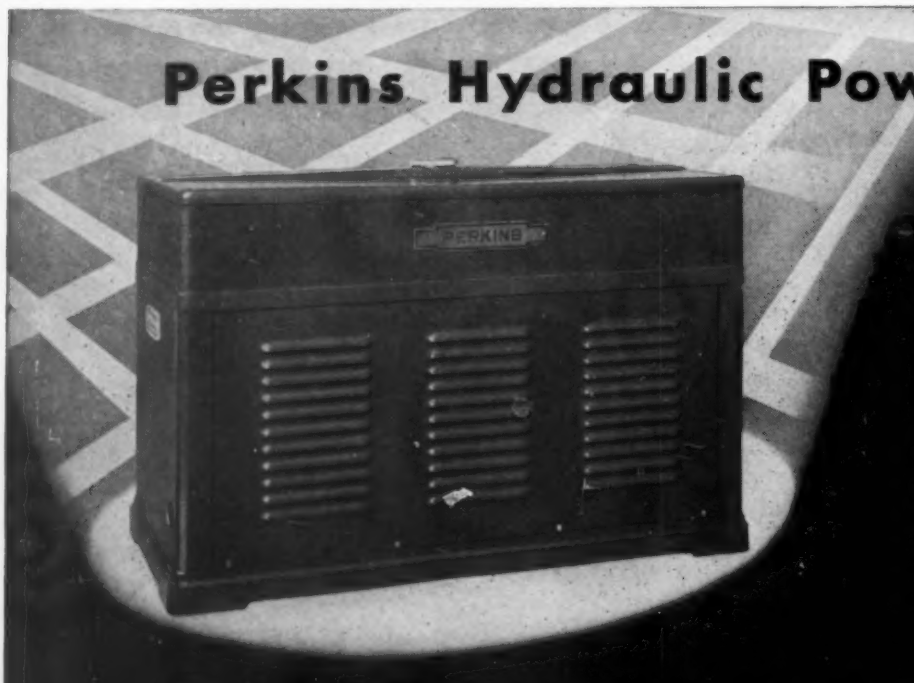
Since 1702, we have specialized in producing fine leather products. In this tradition, Tannate Leather Packings are made with the greatest care and exactitude to fit your specificatjons and to assure long, dependable service. Because of Tannate's tough, pliable, oil resistant qualities they effectively seal-in lubricants and many chemicals. Available for hydraulic or pneumatic service over a wide range of pressures and temperatures.

Write for complete specifications.

PRODUCERS OF FINE LEATHER FOR 249 YEARS

J. E. RHOADS & SONS
35 NORTH SIXTH ST., PHILA. 6, PA.

Perkins Hydraulic Power Unit



Application – Proved

Perkins Hydraulic Power Unit combines high efficiency and quiet operation . . . completely enclosed for maximum safety . . . The Perkins Unit is proving high worth in a wide range of applications. Made by manufacturers of long and broad experience in the design and manufacture of quality industrial machinery.

B. F. PERKINS & SON, Inc.

Hydraulic Division

HOLYOKE, MASSACHUSETTS

Manufacturers of Industrial Machinery Since 1873

2400 Tubes an Hour Chamfered and Expanded

(Continued from page 37)

4 are idle and 7 and 8 are empty.

The tubes are held in the index plates by clamp cylinders which are supplied with oil by one stage of a two stage vane pump. The head moving cylinders are also supplied from this stage.

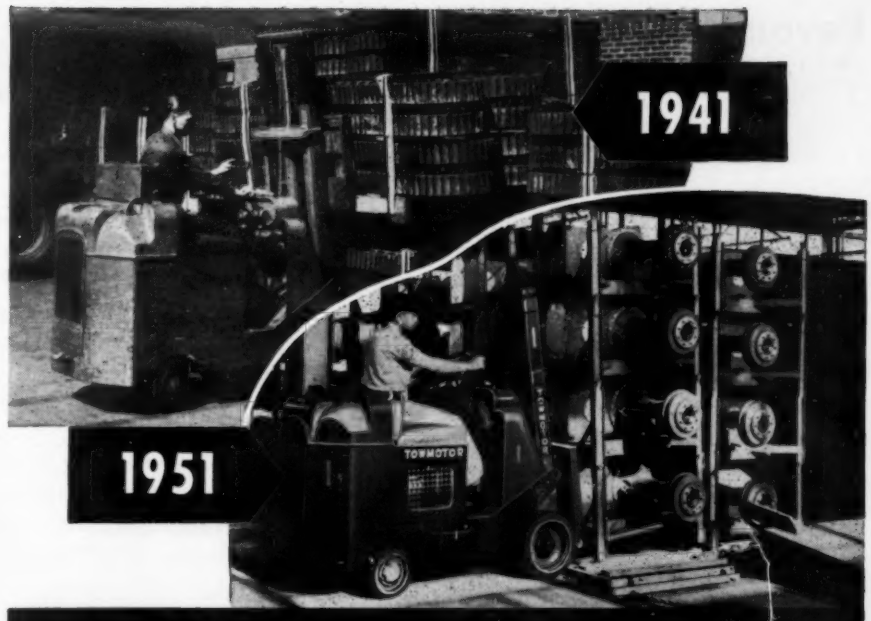
Selection of valve control was determined by the required high cycle speed of approximately 40 per minute. Direct solenoid operated valves met this requirement. The flow control valve in the drive circuit permits regulation of indexing speed.

Powering the Geneva Index

Hydraulic control of the Geneva indexing mechanism was chosen because it provides an easy means of variable control. The fluid motor works through a gear reducer to provide the low rpm that is required. Pressure in this circuit is kept low, approximately 160 psi, to protect the Geneva mechanism in case of jamming. The pump supplying the fluid will unload, stopping the motor if pressure should build up beyond the setting of the relief valve.

Cycle of operation is timed automatically by the actuation of the solenoid valves which are energized by the tripping of limit switches. The accompanying bar graph illustrates the complete cycle.

Another interesting design feature is the simple built-in automatic pressure lubrication system. A small cylinder, acting like a single piston pump, is mounted behind each of the two moveable heads. On each in and out movement of the tools, the cylinder plunger moves to provide a shot of oil to the chamfering tool spindle ways.

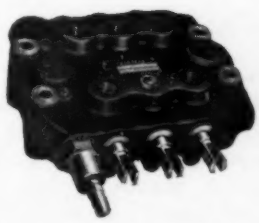


HYDRECO OIL HYDRAULIC
PUMPS • VALVES • CYLINDERS
once again help speed American Defense

When America was The Arsenal of Democracy, HYDRECO-equipped hydraulic lift trucks like the Towmotor pictured above, helped to revolutionize material handling in the new defense industries.

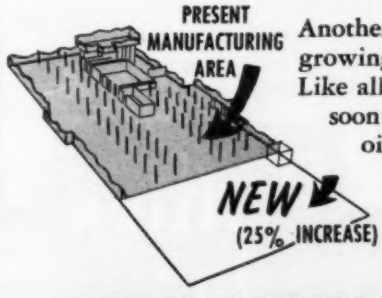
Now once again, HYDRECO-equipped industrial lift trucks, such as this '51 Model LT40 Towmotor, are "mass-handling" industrial products to help speed American defense.

A 1500 Series HYDRECO gear pump, designed to operate at full engine speed, is directly coupled to the Towmotor engine to provide always-ready hydraulic power.



HYDRECO Hollow-Plunger control valves are used on these Towmotor trucks to cut out lost motion in picking up and stacking, as HYDRECO valves provide smooth and accurate control in raising, tilting, and accessory operations.

On the LT40 Towmotor, both tilt and lift cylinders are also HYDRECO-built. Designed for operation under all conditions, efficient wipers and cylinder packing *keep oil in and dirt out* of the hydraulic system.



Another new addition to HYDRECO's fast-growing plant is scheduled for completion soon. Like all HYDRECO facilities, this addition will soon be devoted entirely to the production of oil-hydraulic pumps, valves and cylinders for the materials handling, earth moving, road building and other equipment industries.

HYDRAULIC EQUIPMENT COMPANY
1104 EAST 222nd STREET • CLEVELAND 17, OHIO

Revamp Your Drilling Machines To Make Production Records

(Continued from page 34)

that of the rack previously used for the mechanical feed and an adjusting screw with 4 inches of travel. Much of the electrical wiring and hydraulic piping was done on the control panel and hydraulic panels before they were mounted to the machine.

The main bracket which holds the cylinders was placed on top of the machine and roughly centered. Critical alignment of the cylinders, to assure straight line piston action, was obtained by first using test bars in place of the cylinders and by adjusting temporary screw eyes on the ends of the shaft which is to hold the piston rod ends.

With the main bracket centered on top of the column and in alignment with the eye bores, two holes were transferred, drilled and tapped in the top face of the column for socket head cap screws, which secure the bracket to the column for doweling. With the bracket in this doweled position, the spindle speed gear box mounting holes were transferred from the column to the bracket, because the same cap screws secure both the gear box and bracket to the column.

Finishing the Conversion

With the machine work and electrical wiring completed, the bracket and eyes were placed permanently in position; the spindle speed gear box placed on top of the bracket, aligned from the drill head drive shaft, bolted and doweled in place. The cylinders complete with hydraulic tube fittings and adapters were fastened to the bracket, and piped to the hydraulic control panel, completing the conversion except for relocating the positive stop, lengthening the drive belt, replacing the belt guard, and filling the hydraulic reservoir. The total time to complete these conversions has been less than two work shifts of eight hours each.

Interrupted Feed, Coarse Feed and Fine Feed Provided

Fig. 4 shows the basic hydraulic circuit for single feed and plain stops. Should an interrupted feed be desired requiring an arrangement of "jump stops", the action can be obtained by designing the stop carrier with two tee slots and stops in such a manner that they may pass one another in their positions up and down the carrier. Stops for this purpose should have angular faces eliminating the over travel. Use of these stops require a fourth limit switch providing automatic control for rapid forward and that the limit switch-

(Continued on page 75)

ENGINEERED
Precision
Where You Must Have It!
Highest Quality
Molded Packings
For
HYDRAULIC
and PNEUMATIC
CYLINDERS
PRESSES • PUMPS
VALVES
Low cost insurance against leakage and failure regardless of pressures. Low maintenance costs. PERIFLEX packings are pressure molded from a special quality neoprene and fabric compound and are held to precision limits. Let us send you our catalog that lists the wide range of standard molds carried in stock.
Cup is precision molded to hug cylinder wall and sweep in traverse action.
CUPS
FLANGES
"U" RINGS
"O" RINGS
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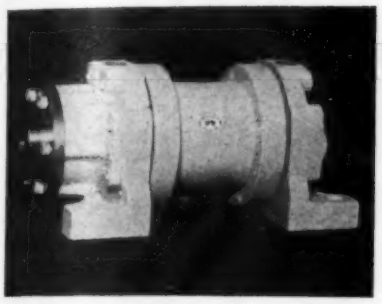
HAZEL PARK • MICHIGAN

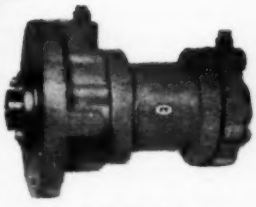
Circle 48 on Reader Service Card

POWER-PLUS
HYDRAULIC CYLINDERS



- DEPENDABLE
- ECONOMICAL
- EFFICIENT
- VERSATILE

• Designed and constructed to J.I.C. Standards the new Power-Plus hydraulic cylinders are available in seven standard mountings —bores from 1" to 24"— strokes to 18 feet. Special hydraulic cylinders are also furnished to meet your requirements. Write today for detailed information and engineering data. *Prompt deliveries.*

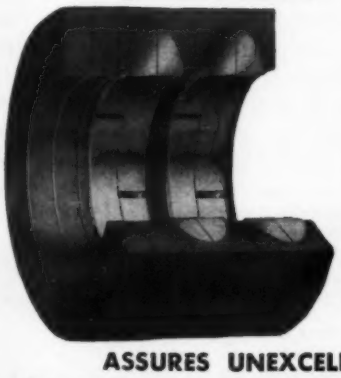


- 200 P.S.I.
- 750 P.S.I.
- 1500 P.S.I.
- 3000 P.S.I.

NEPTUNE-POWER PLUS PRODUCTS
Company
2228 Bellevue, Detroit 2, Michigan

MONOPAK
METALLIC PACKING

Prolongs the Life of Hydraulic Cylinders



Seals against Oil, Water, Brine, Air, Gases and Refrigerants

ASSURES UNEXCELLED DURABILITY

Burst-proof, does not blow out . . . Compact and easy to install . . . Low Friction insures long life. Now adopted by hundreds of manufacturers and users of machine tools.

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439 E. Fort St. • Detroit 26, Mich.

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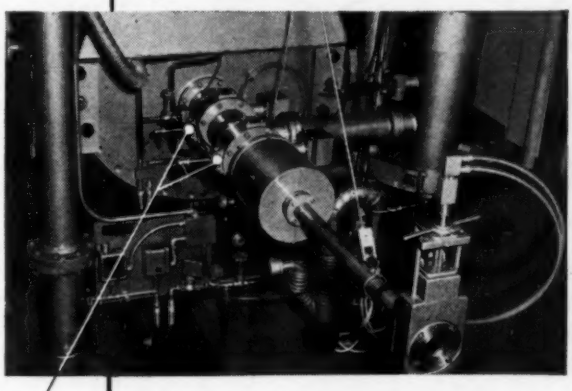
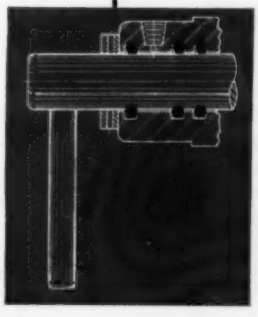
headaches,
dependable
performance



...with



LINEAR
PRECISION MOLDED
"O" RINGS

The Van de Graaff Electron Accelerator, a product of High Voltage Engineering Corporation, utilizes the dependable performance of LINEAR "O" Rings in its vacuum systems.

Typical is their incorporation in the gate valves, shown above, where they have permitted a more straightforward design . . . resulting in simplified construction and operation. The detail drawing shows the manner in which they provide positive vacuum seal under continuous use.

LINEAR "O" Rings are compounded of natural or synthetic rubber, fluorethylene polymers, and "Silastics" . . . are molded in a complete range of J.I.C. and A.N. standard sizes, as well as hundreds of non-standard sizes for special uses. Produced under rigid supervision and held to the closest of tolerances, LINEAR "O" Rings can be depended upon for continuous and lasting service . . . mighty important in these days of critical material shortages.

For easier installation and reduced maintenance, it will pay you to consult LINEAR during the design stages of your sealing applications.

"PERFECTLY ENGINEERED PACKINGS"
LINEAR
LINEAR, Inc., STATE ROAD & LEVICK ST., PHILADELPHIA 35, PA.

Circle 70 on Reader Service Card

A NEW Lightweight Champion!

Characteristics	OLD TYPE	YOUNG A-800
SPECIFICATIONS		
WEIGHT	445 lbs.	230 lbs.
LENGTH	90 in.	49 in.
TUBE DIAM.	⅜ in.	¼ in.
COOLING CAP.	Same	Same
LIST PRICE	$485.00	$370.00

YOUNG A-800 SHELL-AND-TUBE HEAT EXCHANGER OFFERS COMPACTNESS—LOW COST

There is 20% more tube surface per unit volume of space in the new Young A-800 Heat Exchanger. This has been accomplished by better utilization of space within the shell and, as a result, offers new economy in clean water cooling of oil or hydraulic fluids.

Its fixed tube bundle is another space-saving feature. The Young-designed fabricated bonnets assure smooth inlet-outlet flow with minimum impact on headers, and are removable for ease in cleaning and inspection.

Check the complete Young Line before making your next purchase.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications. Young Quality. Heating, Cooling, and Air Conditioning Products for Home and Industry.

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YOUNG RADIATOR COMPANY

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Plants at Racine, Wisconsin and Mattoon, Illinois

DISCOVER FOR YOURSELF NEW HEAT TRANSFER ECONOMY

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Rush me the facts about your ☐ Fixed ☐ Removable Tube Bundle Heat Exchangers, without obligation.

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Circle 68 on Reader Service Card

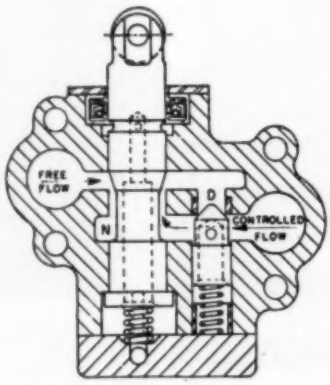
DECELERATION VALVES

Hydraulic Series

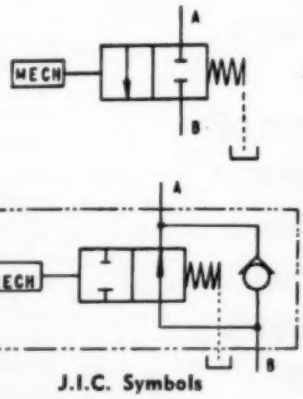
Deceleration or shut off controls are also known as rapid traverse valves. They are used in many circuits to slow down the travel of a cylinder as the cylinder reaches the end of its stroke. The valve acts to cushion the stop.

The valve may have a built-in check valve to provide free return flow. Normally open and normally closed valves are commercially available.

Using the normally open valve, schematically shown here, oil flows freely through the valve in the direction shown to rapidly traverse a cylinder. As the cylinder, nears the end of its travel, a tapered cam depresses the valve spool to gradually reduce oil flow to the cylinder. Cylinder travel decelerates until complete shut off of oil flow brings the cylinder to a stop.



Deceleration Valve



J.I.C. Symbols

Some deceleration valve designs include a built-in needle valve which can be threaded in or out to provide a small amount of flow through the valve even when the spool has been shifted completely closed.

The sixth in a series showing the symbol and a typical schematic of the valve it represents.

10-DAY DELIVERY!

SIMPLEST... MOST COMPACT

O-M

AIR HYDRAULIC WATER CYLINDERS

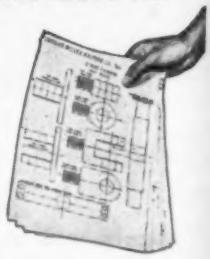
Add up these advantages. They are the reasons why more and more equipment manufacturers are specifying Ortman-Miller cylinders for all types of applications.

Simplicity of design eliminates tie rods and bulky end caps . . . saves one-third in installation space. All parts and mounting brackets interchangeable bore for bore. Cost less to buy, install and service. Full range of sizes (1½" to 8" bores) **available for early shipment.** Machined steel (no castings) and bearing bronze throughout.

Write today for details! Speed production, cut costs and save space with Ortman-Miller cylinders.

FREE TEMPLATES

For the first time in the industry, O-M offers a complete set of templates showing all cylinders and mounting brackets. ½ scale. Your set on request.



ORTMAN-MILLER

MACHINE CO., INC.

1204 150th Street, Hammond, Indiana

Circle 69 on Reader Service Card

(Continued from page 72)

es be mounted upon the switch plate at two separate heights. With rapid forward and neutral switches mounted at one height and the reverse and feed switches at the other, good results are obtained. Should a coarse and fine feed be required a similar hydraulic valve panel is used with a solenoid operated valve for metering the oil through the second flow control. This requires the use of a stop carrier with two tee slots and stops similar in design to those used for an interrupted feed, as well as an additional limit switch and a latching type electrical relay for controlling the additional solenoid. A combination of both the above arrangements is accomplished by use of the same stops and carrier, but the electrical equipment for each is required, making a total of five limit switches that will control any of the above conditions.

It can now be seen that this conversion is very flexible and lends itself to most multiple drill applications, producing both in quantity and quality comparable to that of new machines.

THE MARKET PLACE

Classified Advertising

Rates: For "Positions Wanted" $4.00 minimum, limit 25 words. For all other classifications $4.50 minimum for 25 words, each additional word 15c; bold face type or all capitals, $7.50 minimum for 25 words, each additional word 20c; limit 50 words. Box addresses count as five words.

DISTRIBUTORS OR REPRESENTATIVES — wanted in principal cities to handle complete, quality line of air and hydraulic cylinders, valves and valve actuators. Write, stating lines now being handled, territory covered, and references. Ledeen Mfg. Co., 1600 So. San Pedro St. Los Angeles 15, Calif.

CMP Booklet

The "ABC's of CMP", a 16-page booklet just issued by NPA, outlines the principles and operating procedures of the Controlled Materials Plan. The booklet describes how the plan works, gives the roles of industry and government, lists principal regulations and the CMP product classification. Copies of the "ABC's of CMP" may be obtained without cost from the National Production Authority, Washington, D. C. or from field offices of the Department of Commerce.

1951 Hydraulics Conference

The 1951 National Conference on Industrial Hydraulics will be held November 7 and 8 at the Sherman Hotel, Chicago, according to an announcement made by F. W. Edwards, Conference secretary.

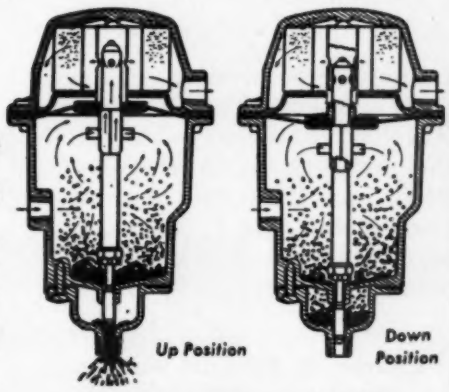
mail Coupon for complete information on how to get greater efficiency from Compressed Air Equipment

Plant engineers report "tool maintenance costs reduced 12%". "Eliminating manual operated equipment speeds up production and gives longer tool life." "For the first time we feel we have whipped condensates in our compressed air applications."

PROVED CONTROL OF ALL CONTAMINANTS

Actual plant installations give definite proof that the Wilkerson Diaphragm Operated Valve increases production because it separates, traps, filters and automatically drains contaminants from compressed air lines.

One moving part coupled with strong construction of corrosive resistant materials assure long, trouble free life. Double O-ring seal transmits full force of air without pressure surge—holds pressure drop to a minimum.



1 VALVE DOES 4 JOBS...

Separates • Traps • Filters
Automatically Drains

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Gentlemen: Please send catalog illustrating complete Wilkerson line with operating and installation data on how to increase life and efficiency of compressed air equipment.

☐ Check here if you would like a demonstration in your own plant—on any application you choose.

Name_____ Title_____

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POST SCRIPTS OF INDUSTRY

NEWS · VIEWS · TRENDS

Harold Maron has joined **Nielson Hydraulic Equipment, Inc.**, 298 Lafayette Street, New York City, as sales engineer in charge of the area covering the New England states and parts of New York state.

Compressed Air Products has moved their Brooklyn office from 400 Third Avnue in Brooklyn to larger quarters at 257 Greenwich Street, New York 7.

Ralph H. LeBow has joined the **Parker Appliance Company** as staff engineer for aircraft fuel system components, it is announced by Robert H. Davies engineering manager of the company.

The Cleco Division of the Reed Roller Bit Company, Houston, Texas, has announced the appointment of **House of Pfaff**, Inc., 10-36 49th Avenue, Long Island City 1, New York as distributors of Cleco products in that area.

Charles R. Schmitt has been appointed manager of the lubrication sales department of the **E. F. Houghton & Co.** Mr. Schmitt, formerly lubrication manager for the Central and Western Division, has been transferred to the company's main office in Philadelphia from Cleveland.

Precision Rubber Products Corporation of Dayton, Ohio announces the completion of its second major plant expansion within the past year. This $150,000 expansion program includes additional manufacturing, warehouse and office space which with additional new production equipment is expected to increase capacity by one-third.

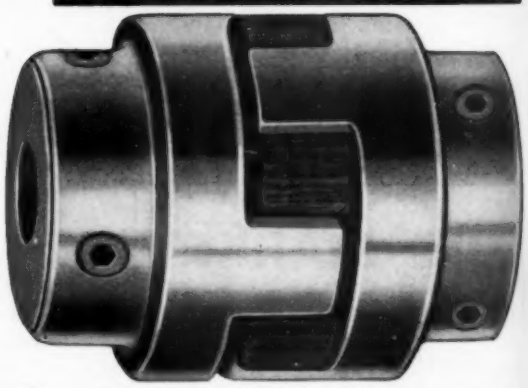
Robert F. Anderson has been named sales promotion manager of **Eagle Signal Corporation.**

Barksdale Valves, has moved to their own plant at 1566 East Slauson Avenue, Los Angeles. **L. S. Barksdale,** president, has annuonced his resignation as vice-president of the W. R. Whittiker Co., and general manager of the Saval Division, and will devote his full time

Eliminate Backlash on direct drives with

LOVEJOY L-R FLEXIBLE COUPLINGS

DOES NOT NEED LUBRICATION . . . INSTALL IT, THEN FORGET IT



The greater flexibility of these expertly designed couplings removes the strain between the motor and the machine, permitting end play and back-lash of the motor shaft. The load is so distributed that specific pressure is kept below the safe maximum.
The power line that is misaligned; that cannot stand a speed-up without whip or back-lash does not fit in modern industry. You can be sure of maximum efficiency only with good couplings fitted to the special requirements of a particular job.

LOVEJOY L-R COUPLINGS can stand misalignment. Write for this Catalog and Selector Charts. They give you all the data and quick information you need to select the couplings best suited to your needs.

LOVEJOY FLEXIBLE COUPLING CO.

5037 W. LAKE ST. CHICAGO 44, ILLINOIS

Also mfrs. Lovejoy Variable Speed Transmissions and Lovejoy Universal Joints

Circle 73 on Reader Service Card

VICKERS multiple unit valves for the best hydraulic control of mobile equipment

NEW!

Vickers Multiple Unit Valves provide every desirable feature of custom design at production-line prices. Vickers sectionalized construction permits you to specify the exact control functions needed and no others; yet you pay no special design or production costs.

To meet various control needs (original specification or conversion) and to make many combinations without unwieldy inventory . . . use the Vickers sectionalized valve assembly.

To control motion positively and accurately . . . you get Vickers exclusive load inching control (also makes it nearly impossible to jar or dump a load unintentionally).

To obtain any type and size of valve unit . . . Vickers provides 11 types of valve sections in four pipe sizes.

To hold load position while operating other machine components or while pump drive is stopped . . . Vickers has the back flow prevention check valve.

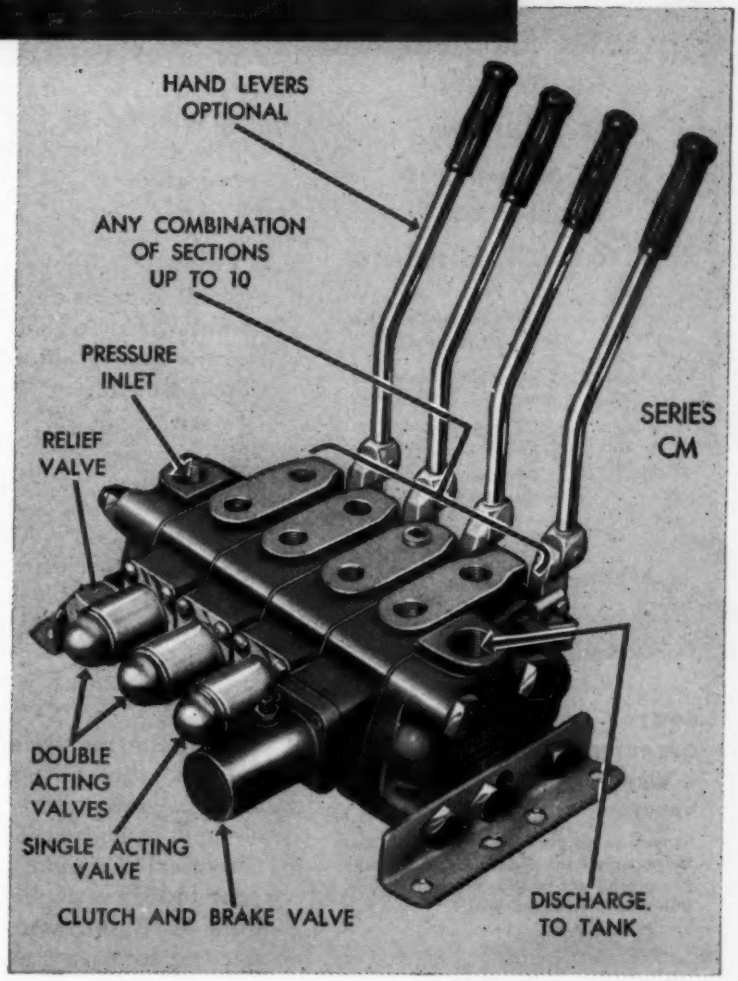
To prevent overload and damage to machinery . . . the assembly includes a Vickers positive-acting factory preset relief valve.

To assure a leak-proof, drip-proof system . . . Vickers nested "O" ring seals between valve sections and on valve plungers.

To make valve operation complete . . . Vickers furnishes spring loaded valve plungers (rugged operating levers optional).

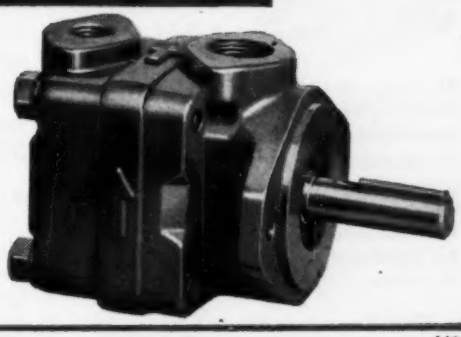
To get full capacity for piping or tubing size . . . Vickers rates valves conservatively at 18 gpm for the ½" size up to 48 gpm for 1".

To obtain the utmost in performance and dependability . . . use a 100% Vickers hydraulic system including Vickers Vane Type Pumps. (See below.)



VICKERS balanced vane pumps for mobile equipment

These pumps are tough and long-wearing. Hydraulically balanced construction eliminates pressure-induced bearing loads. Automatic wear compensation maintains correct radial and axial running clearances throughout pump life . . . efficiency and delivery rate remains high. Series V-200, V-300 and V-400 range in capacity from 2 to 73 gpm. Operating pressures up to 1500 psi. Available also as double pump. Get full details from the Vickers Application office near you, or write for Catalog M-5100.



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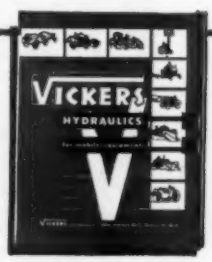
ASK FOR → *New Catalog* M-5100



VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1474 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices:
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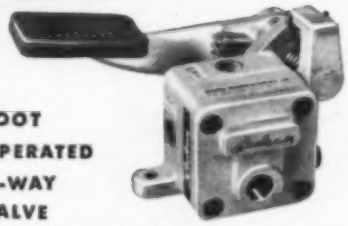
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

Ledeen VALVES

14 Models for Positive, Easy Actuation of Air or Hydraulic Cylinders

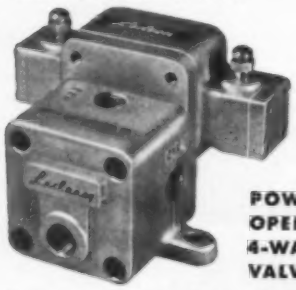
HAND OPERATED 4-WAY VALVE

A simple, economical valve, suitable for most requirements. Requires only light turning effort. Built for long life.



FOOT OPERATED 4-WAY VALVE

Leaves hands free for other work. Requires only light pedal pressure. Works like accelerator throttle. Particularly valuable for women workers.



POWER OPERATED 4-WAY VALVE

For remote control with or without electricity. Can be controlled by microswitch, cam, finger or toe operation.

Ledeen Valves embody the rotating disc construction, and are designed for controlling the flow of air, oil or water. They are made in 14 different models for 5 different cycles, in 6 sizes.

Write for Bulletin 510

Ledeen Mfg. Co.
1610 So. San Pedro St.
Los Angeles 15, Cal.

Circle 75 on Reader Service Card

to Barksdale Valves. **M. C. Nelson** has been promoted from chief engineer to general manager.

Myron B. Gordon, formerly an officer and director of Curtiss-Wright, Wright Aeronautical, and Fairchild Engine and Airplane corporations, has been elected to the Board of Directors of **Air Associates, Incorporated.**

Franklin I. Fickett, has been appointed sales engineer in Indiana, Ohio and Michigan for **Hunt - Spiller Manufacturing Corp.,** Boston.

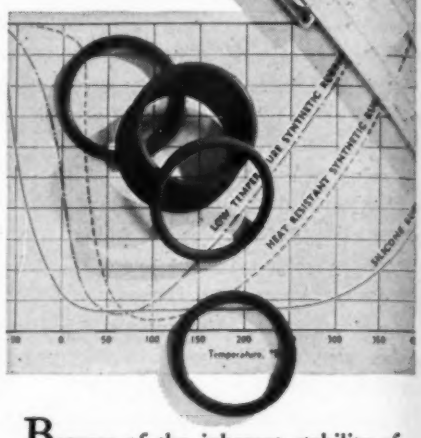
Edward Barwell has been named industrial relations coordinator of **Worthington Pump and Machinery Corporation** to assist L. C. Ricketts, vice president in charge of manufacturing.

Dr. Charles Allen Thomas, one of the nation's leading atomic scientists has been elected president of **Monsanto Chemical Company.** The 51 year old scientist replaces **William M. Rand,** who retires under the company pension plan.

Fred H. Haggerson, president of **Union Carbide and Carbon Corporation,** has also been elected chairman of the Board of Directors. Mr. Haggerson has been president since 1944 and has been associated with the Corporation for over 30 years.

The appointment of **Albert B. Diss** as manager of manufacturing operations has recently been announced by the **Watson-Stillman Company.** Mr. Diss, who joined the Watson-Stillman organization in November 1950 will head all activities in the manufacturing, production, purchasing and subcontracting departments.

SILICONE "O" RINGS OFFER UNIQUE DESIGN POSSIBILITIES



Because of the inherent stability of silicone rubber, Arrowhead "O" rings molded of this remarkable new material provide a long-lasting seal under conditions far beyond the limits of ordinary rubbers. For example, they remain flexible at -130° F.; withstand indefinitely, exposure to temperatures of 500° F. and over. They offer excellent resistance to oxidation, to many oils, acids, alkalies and a variety of chemicals. The ideally inert characteristic of these seals is demonstrated by their astonishing resistance to aging, even at abnormally high temperatures. At normal temperatures they last *indefinitely.* For superior performance under severe conditions, consider silicone rubber. Arrowhead's *silicone specialists* will welcome your inquiry.

Write **FOR ENGINEERING DATA**

Free to Engineers—two valuable new publications on silicone rubber and "O" rings. Contain complete technical and descriptive data, including typical applications.

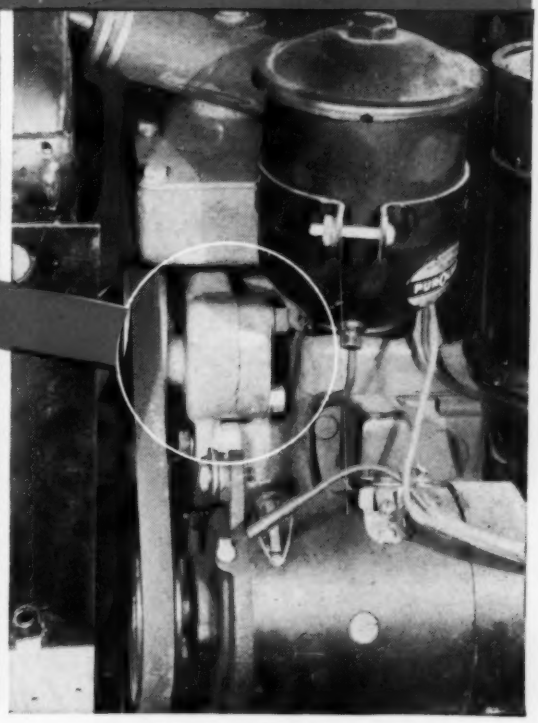
ARROWHEAD RUBBER CO.
Division of
National Motor Bearing Co., Inc.
DOWNEY (Los Angeles County) CALIF.

"O" RINGS ▼ SILICONES ▼ AIRTRON-DUCTS

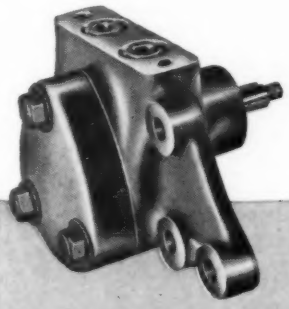
Circle 76 on Reader Service Card

Another Job for Pesco HYDRAULIC MUSCLES

"The sensitive response of the hydraulic system permits such trigger-fine adjustment that operators are loud in their appreciation," says Massey-Harris . . . *the sales power of hydraulic power in action.*



Circle shows position of Pesco pump.



Pesco pump designed for Massey-Harris Pony tractor. Capacity: 2.5 g. p. m. @ 2880 r. p. m. @ 1000 p. s. i.

Pesco *Dual Purpose* Pump Eliminates Extra Power Shaft on Massey-Harris Pony

The problem was to eliminate all unnecessary weight and cost and save space on a small tractor.

So Massey-Harris tractor engineers and Pesco hydraulic engineers teamed up . . . together came up with a specially designed dual purpose hydraulic pump to serve as both pump and fan bearing mounting.

Result: less space and weight required . . . necessity for an extra motor power shaft is eliminated.

Such teamwork between Pesco and client engineers is frequent. Matching hydraulic know-how and skills with the engineering knowledge of a manufacturer's engineering staff is the way we at Pesco like to work. It is teamwork that puts the sales power of hydraulic power to work to full advantage for our customers.

If you have a problem in hydraulics Pesco engineers will gladly co-operate with your engineers to solve it. Write today.

engineering Pesco production

PRODUCTS DIVISION

BORG-WARNER CORPORATION

24700 NORTH MILES ROAD BEDFORD, OHIO

Circle 2 on Reader Service Card

Guard Your Family STRIKE BACK!

GIVE to Conquer Cancer

IF SOMEONE IN YOUR FAMILY HAD CANCER, you would do anything . . . everything that would help. And today there is so much that you can do to help. Tens of thousands of families just like yours meet cancer every year and triumph over it. But we are still losing too many men and women we love.

Doctors can now cure half of those who develop cancer if the disease is diagnosed in its early stages. Yet in 1950 some 210,000 families lost a father, a mother or a child to cancer. Many of them—probably 70,000—could have been cured.

To save more lives, we all must help.

Your gift to the Cancer Crusade will help guard your family by providing more research, more life-saving education, more training for scientists and physicians, more equipment, more services for those already striken with the disease.

Cancer is man's worst enemy. Striking back at cancer costs money. Any contribution is welcome but, the fight against this major threat deserves major support: dollars—tens—twenties—hundreds of dollars. Will *you* help?

AMERICAN CANCER SOCIETY

Applied Hydraulics